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MANAGING ARCHEOLOGY: A BACKGROUND DOCUMENT FOR CULTURAL RESOURCE MANAGEMENT ON THE APACHE-SITGREAVES NATIONAL FORESTS, ARIZONA

FOREST SERVICE, ALBUQUERQUE, NM.
SOUTHWESTERN REGION

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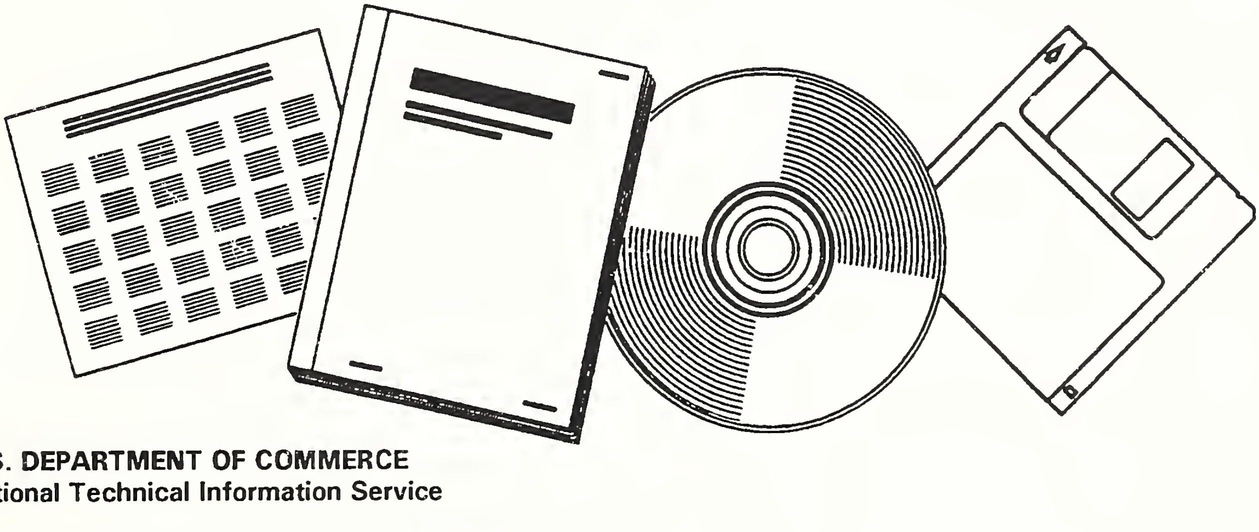

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MANAGING ARCHEOLOGY:
A BACKGROUND DOCUMENT FOR CULTURAL RESOURCE MANAGEMENT ON THE APACHE-SITGREAVES NATIONAL FORESTS, ARIZONA

By

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May 1981

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Management implications for cultural resources on the Apache-Sitgreaves National Forests, Arizona, are addressed. The data base consists of a one percent sample of all lands above the Mogollon Rim and 10 years of block survey and excavation on various parts of the Forest. The nature of both historic and prehistoric resources is described along with potential impacts to those resources. A chapter on predicting cultural resource distributions, the nature of the archeological record, and management recommendations complete the volume. A Ranger District by Ranger District summary is included in the appendix.

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CONTENTS

FIGURES

TABLES

PREFACE

During its first decade (the 1970s) cultural resources management has been more concerned with compliance than with management. Much of the reason had to do with the lack of inventory. It is rather difficult to manage a resource when you do not know where it is or how it can be characterized. In 1975 the Apache-Sitgreaves National Forests embarked on an ambitious program to inventory a one percent sample of their approximately 2,200,000 acres. This document contains the results of that project for lands located above the Mogollon Rim.

The project was conceived by Drs. Fred T. Plog and Dee F. Green. Dr. Plog, currently Chairman of the Department of Anthropology, Arizona State University, had been working in the Sitgreaves Forest since 1971 and had been experimenting with sampling strategies for archeological inventory. Dr. Green, as Regional Archeologist for the Southwestern Region, was concerned with the magnitude of the problem of inventorying the Region's 22 million acres. His advocacy of sampling as part of the solution coincided with Dr. Plog's interest in the cultural resources of the Forests and with a forward looking attitude by then Forest Supervisor Jim Kimball. Support from Lee Redding, Recreation and Lands Staff on the Forest, as well as Bruce Donaldson, a student of Dr. Plog who was doing much of the actual sampling inventory and who has become the Forest Archeologist, have combined to sustain the project over the past several years.

The value of the enterprise as reflected in this report is really fourfold. First, Apache-Sitgreaves personnel have a document which gives them guidance regarding the nature and extent of cultural resources over the Forests. Second, managers of other forest resources will find guidance in coordinating the cultural with the natural resources. Third, the project serves as a model for other forests who have abundant cultural resources. Not that it should be slavishly copied, as Dr. Plog points out, but that the strengths of the project can be utilized and what has been learned can make the next effort more cost effective. Fourth, the profession of archeology has acquired an unprecedented body of data which can be utilized not only to help satisfy the curiosity of archeologists about past human behavior but can be interpreted to the benefit of the general public who share that curiosity.

Dr. Plog's efforts in bringing together this report, then, stand as a major contribution to cultural resource management. It helps set the stage for the 1980s, especially here in the Southwestern Region of the Forest Service, as we move from compliance to management in dealing with our rich cultural heritage. It is with considerable pride that we make this report available to land managers and public alike.

JAMES C. OVERBAY
Deputy Regional Forester
Southwestern Region

ACKNOWLEDGEMENTS

In a project spanning as many years as this one, a large number of people deserve thanks for the success of the effort. The fruitful relationship between the project and the Forest Service was initiated by the interest of Stan Tixier, Hal Harper, and Wally Rutledge in our NSF supported research. The relationship grew as a result of the efforts of John Tom Koen and Dee Green in the Region 3 Office to develop an understanding of cultural resources on the Region's forests and the interest of Lee Redding, James Kimball, and Arlie Holmes in seeing that the Apache-Sitgreaves Forests cultural resources were both understood and wisely managed. John Hart, Quentin Cole, Merrill Richards, and Adrian Hill have greatly facilitated aspects of our work when it occurred on their districts.

Many of the directions that the generation of management data have taken were initiated by Bruce Donaldson in his treatment of the White Mountain Planning Unit. The students who worked on the Little Colorado Planning Unit report--Jeff Hantman, Julie Francis, Roberta Jewett, Kent Lightfoot, and Jon Scott Wood--were responsible for major refinements in that approach. Steadman Upham, Judy Brunson, Kent Lightfoot, and Jeff Hantman directed many of the detailed analyses that informed this report. Many, many students at the State University of New York, Binghamton and Arizona State University undertook specific analyses that allowed the project to proceed well beyond the limits of available fiscal resources. The USDA Forest Service, the National Science Foundation, Arizona State University, and the State University of New York, Binghamton supported the effort.

The help of Forest Service employees Donna Calkins, who typed the final manscript, and Jeff Boyer, who prepared some of the illustrations, is appreciated.

I very much appreciate the help of all of these individuals and institutions. Without their help, the project would in all probability have terminated years ago resulting only in a sample of a small area of the Forests.

INTRODUCTION

The concept of planning for cultural resources management is a relatively new archeological concept. As used here, the term refers to a proposal for the phased development of understanding of the cultural resources of an area, coupled with guidelines for the wise use of those resources by land managers, scientists, and citizens alike. In pursuing the first goal, it is assumed that immediate knowledge of all cultural resources is neither desirable nor feasible. Increasingly refined information obtained through the application of sampling strategies is, therefore, basic. In pursuing the second goal, the guiding concept is that of significance as defined in the Code of Federal Regulations (36 CFR 60.6) and as modified by current archeological use.

Major sections of this document address the following topics:

(1) The Natural Environment. Aspects of the natural environment relevant to the management of cultural resources are discussed.

(2) Data Base. The data set that will be used in assessing management problems is described.

(3) Survey Strategy. The means by which these data were collected are indicated.

(4) Prehistory and History. Current understanding of the history and prehistory of the area is reviewed.

(5) Nature of Cultural Resources. Major categories of cultural resources are identified.

(6) Nature of Impacts. The major impacts occurring to these resources are listed.

(7) Quantity of Cultural Resources. The total number of cultural resources occurring in the study area are described from a number of perspectives.

(8) Resource Distribution. A variety of techniques are used in describing the distribution of cultural resources within the study area.

(9) Predictive model. More refined means of identifying likely locations of cultural resources are considered.

(10) The Archeological Record. The characteristics of the archeological record that are important to interpreting that record and this report are identified.

(11) Resource Management. A variety of strategies for effectively managing the cultural resources of the area are considered.

APACHE-SITGREAVES NATIONAL FORESTS

The Apache-Sitgreaves National Forests are in east-central Arizona between Clear Creek, south of Winslow, Arizona, on the west and the Arizona-New Mexico state line on the east. The northern boundary is an irregular line paralleling the Mogollon Rim and between 5 and 30 miles north of that geological feature. From the western boundary of the forest to the vicinity of Greer, Arizona, the southern boundary is the Mogollon Rim. East of Greer the southern boundary is to the north and then just southeast of Clifton, Arizona. The area of the forests is roughly 2.6 million acres (4000 square miles). Within the administrative boundary of the forests are 144,800 acres (226 square miles) of private land.

The area described in this study does not precisely correspond to the description of the forests as given above. First, the area of the Apache National Forest to the south of a line through Alpine, Arizona, is excluded since cultural resource studies for planning purposes have not been undertaken in this area to date. Second, roughly 200,000 (270 square miles) acres of the Coconino National Forest lying east of State Highway 87, (that part of the Coconino within the Mogollon Rim Planning Unit), is treated. Excluding these, and the private land lying within the administrative boundaries of the forests, the total area under study is roughly 1.1 million acres (2000 square miles). The location of the forests is shown in Figure 1. The study area and relevant cultural and natural features within them are shown in Figure 2.

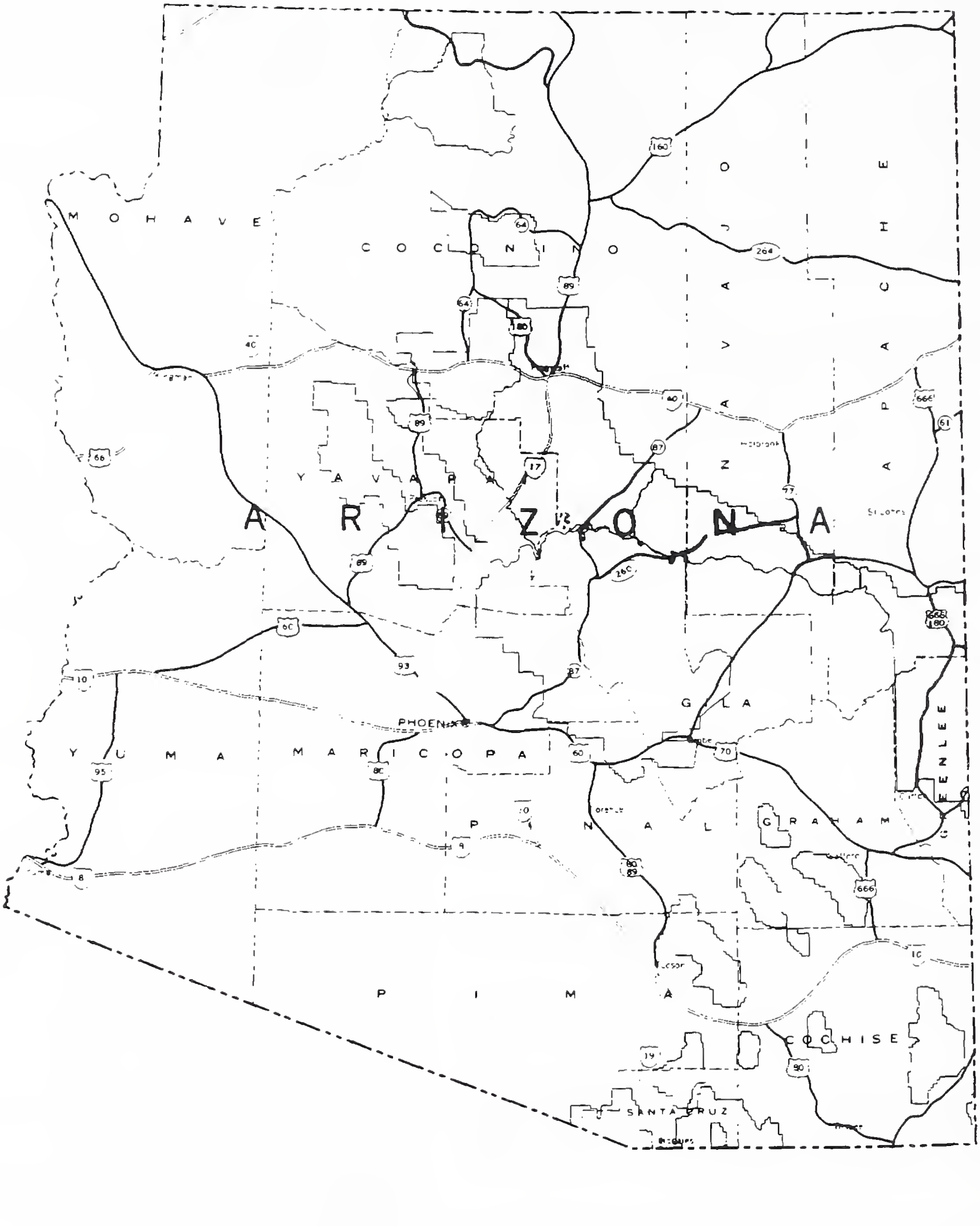


Figure 1. Location of study area.

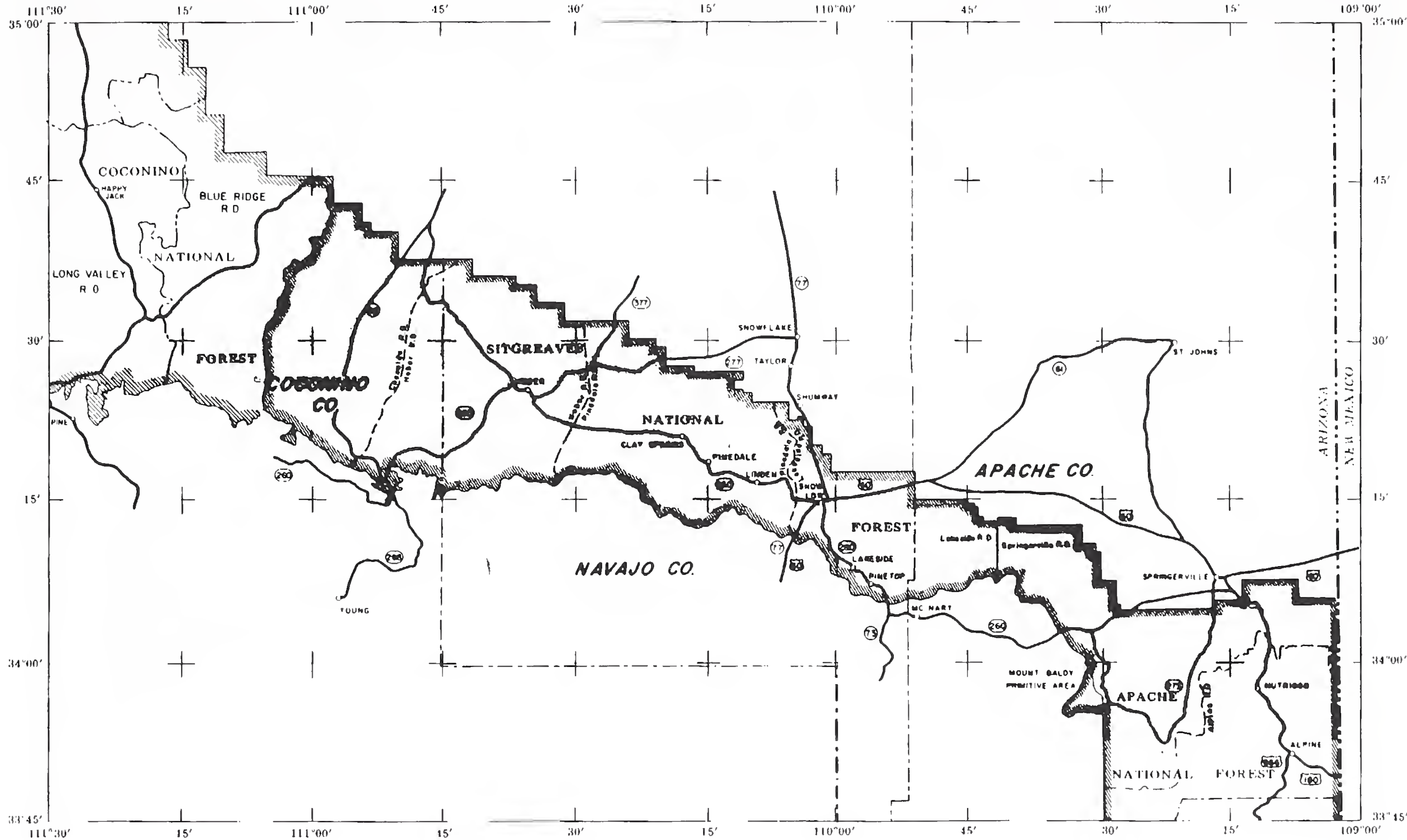


Figure 2. Study area, cultural and natural features.

THE NATURAL ENVIRONMENT

This study provides information essential to managing the cultural resources of the forests. Nevertheless, a description of the natural environment is a necessary beginning point for two reasons. First, the natural environment of the forests constitutes the resources that were available to prehistoric and historic peoples for using the area. Second, cultural resources are differentially distributed in relation to these resources, providing one of the more powerful data bases for extrapolating from known resource distributions to the overall distribution. However, since these other environmental features are studied in far greater detail by other functions of the forests, only summary information necessary to placing cultural resources in an appropriate context is included here. Vegetation, geology, soils, and topography will be discussed.

Vegetation

Elevations on the Forests range from about 6000 to over 11,000 feet. As one would expect, vegetative differences are great. Six communities are present on the Forests: mountain meadow, spruce-fir forest, mixed conifer forest, ponderosa pine-alligator juniper forest, juniper-pinyon woodland, and plains grassland. The use of these communities represents a summary treatment of the studies of Lowe (1974), Atchison and Therou (1974), and Dunstan et al., (1976).

Spruce-fir forest occurs predominantly at altitudes above 8300 feet. The major species characteristic of this biome are Engelmann spruce, white fir, cork-bark fir, and aspen. The major expression of this community occurs at the eastern end of the Forest, although it also occurs as a discontinuous ribbon along the Rim clear to the western edge of the study area.

Arizona fescue, Kentucky bluegrass and tufted hairgrass are the major constituents of the mountain meadow. Forbs such as iris, clover, mint, lambsquarter, and dandelion are other constituents. While the community or modifications of it can be found at altitudes as low as 7000 feet, its major occurrence is above 8300 feet.

The ponderosa pine-alligator juniper community occurs at altitudes of about 6400 to 7000 feet. Gambel and Emory oak, along with ponderosa pine and alligator juniper, define the community. It forms a continuous band across the western end of the study area to about the Apache-Sitgreaves boundary and is discontinuous eastward.

The pinyon woodland community is defined by the presence of pinyon and alligator, Utah, and one-seed juniper. It occurs at altitudes of 6400 to 7200 feet and is continuous across virtually the entire study area.

The grassland community is defined by a variety of grasses (blue-grama, side-oats grama, six-week three-awn, bristle grass), shrubs (rabbit-brush, sagebrush), and cacti (yucca, Mormon tea, prickly pear, cholla). This community occurs at altitudes below 6400 feet. In general, it begins immediately outside of the forests, although there are expressions of the community at the eastern end of the forests.

Clearly, the situation is more complex than these simple distributions. Riparian communities with immense local diversity in the presence of willow, cottonwood, walnut and a variety of shrubs crosscut the altitudeinally zoned communities. Both the boundaries between ponderosa pine and ponderosa pine-alligator juniper forests and between ponderosa pine-alligator juniper-pinyon woodlands are greatly affected by local conditions and their interdigitation is quite complex. Similarly, isolated stands within any one community are sometimes expressions of the communities above or below it.

Geology

Variation in bedrock geology over the forests is complex. This statement is valid even for the immediate subsurface geology that is relevant for the purposes of cultural resource evaluation. In a basic sense, however, the geology of the forests reflects four substantially different circumstances. First, a very large portion of the study area is characterized by immediate subsurface deposits that are volcanic in origin. This area, just west of Show Low, Arizona, east to the state line, and from the northern edge of the forests south to the Mogollon Rim, is a mosaic of basalt flows, cinder deposits, cinder cones, and the sediments derived from the above. Surface expressions range from basalt flows with virtually no overlying sediment to thinly developed sediments.

Second, immediately along the Rim to the west of Show Low, surface deposits are a mixture of sedimentary rocks, sediments derived from them and "Rim Gravel" deposits. The net effect of this admixture is surface sediments that vary between thin ones overlying bedrock and several meters deep gravel deposits with varying mixtures of sediment and gravel-cobbles.

Immediately to the north of this zone, the forests are characterized by surficial geology representing a complex admixture of the Kaibab limestone, and the Coconino and Moenkopi sandstones. The former sandstone is most evident in the more deeply entrenched canyons while the latter occurs as isolated "islands" in a widespread limestone "sea."

Finally, the northern edge of the forests (from roughly Heber to Linden, Arizona, and the deeper valleys between Eager, Arizona, and the Arizona-New Mexico state line) are characterized by softer and deeper deposits reflecting an abundance of sandstone derived sediments in the case of the former and sediments derived from exposures of the Datil formation in the case of the latter.

Soils

The distribution of soils over the study area closely reflects the immediate subsurface geology. In those areas where volcanic materials immediately underlie the surface, soils are generally quite thin. Where Kaibab limestone immediately underlies the surface, soils are also thin, with substantial gravel and cobble inclusions. Soils overlying sandstone, rim gravel, and Datil formation deposits are generally much deeper, often on the order of 30 inches or greater. Throughout the area, of course, the alluvial and colluvial soils of the drainages are deeper than those of the surrounding uplands.

The specific soil constituents are only now in the process of being described. Soil studies have now been done for the former Mogollon Rim, White Mountain, and Little Colorado (eastern sector) Planning Units by the USDA Forest Service. Once these data are available for the intervening areas, soil studies will undoubtedly become crucial for cultural resource planning. In the meantime, the available studies classify variation in such a gross and inconsistent manner as to be nearly useless for planning purposes.

Topography

The most basic topographic distinction in the study area separates the area east of Show Low from that to the west. West of Show Low the land surface is best described as a tableland with moderate to high relief. The land surface has been formed by north-flowing drainages. North trending ridge lines are separated by drainages which are both small and shallow (e.g. Pierce Wash, Purcell Wash) and large and deep (Chevelon and Wildcat Canyons).

The pattern to the east of Show Low is one of low and high mountains. While there are upland surfaces that could be characterized as tablelands, these generally flank the higher valleys. The extensive vulcanism in the area has created a far less regular land surface as evidenced by volcanic peaks and hills with valleys lying between them. Of particular importance, at the immediate eastern end of the study area is a substantial escarpment that separates the upland created by Escudilla, Sierra Blanca and surrounding mountains from the lower lying areas at the northern extreme of the forests.

Hydrology and Precipitation

Detailed hydrological studies are not sufficient for characterizing variation over the forests. An application of Strahler's (1964) drainage rank technique is generally unproductive: variation over the forest is from one and two rank drainages in the uplands to three, four, and five rank drainages at lower elevations.

Precipitation is also a problem because of the paucity of recording stations. In general, the entire area is characterized by a linear relationship between elevation and precipitation from a mean of about 12 inches at 6000 feet to 30 inches at 8000 feet. Year to year variation through the area is substantial. In any given year, there is also a tendency toward great local variation in precipitation. Because it is known only in respect to correlation with elevation, it is not currently possible to study precipitation as an independent variable.

In general, the area is characterized by great environmental diversity. This diversity would have been advantageous to prehistoric and early historic peoples for two reasons. First, the diversity of available resources is high, reflecting overall environmental diversity. Second, given this diversity, whatever the climatic regime of a particular year, decade, or century, some area of the forests might have been a favored human habitat.

DATA BASE

The study area received considerable casual archeological attention but little intensive or systematic work prior to 1970. Very early in archeological explorations of the Southwest, archeologists visited sites on or in the vicinity of the forests (Hough 1903; Bandelier 1892; Spier 1919a, b; Mindeleff 1891). (Given the quality of maps available to these early explorers it is impossible to accurately place some of the sites they recorded; errors of over 15 miles have been noted.)

In the period when tree-ring dating was under development as a viable technique, Show Low, Pinedale, and Bailey Ruins, all on private land within the boundaries of the forest, were visited by Haury and Hargrave (1931). Harold S. Colton conducted periodic surveys through the area that resulted in some site records currently in the files of the Museum of Northern Arizona.

The most extensive long-term research in the vicinity of the forests was that conducted by the Field Museum of Natural History under the direction of Paul S. Martin. Martin and his colleagues first worked at sites in the Pine Lawn and San Francisco River Valleys, a few dozen miles over the Arizona-New Mexico state line (Martin 1943; Martin and Rinaldo 1940, 1947, 1950a, 1950b; Martin, Rinaldo and Antevs 1949; Martin, Rinaldo, and Barter 1957; Martin, Rinaldo, and Bluhm 1954; Martin et al. 1952). From 1955 to 1972 his research was in the Upper Little Colorado Valley. Some sites on the forest were surveyed by Longacre, and excavations were done immediately adjacent to, but never on the forests (Martin and Rinaldo 1960a, b; Martin et al. 1961, 1962, 1964, 1967, 1971).

During the 1960s and 1970s occasional exploration of sites on the forests was done in conjunction with road construction (Vivian 1969; Grebinger and Bradley 1970), and a proposed reservoir (Lindsay et al. 1969). In the late 1960s, John Wilson (1969) conducted an extensive survey of a few localities within the boundaries of the study area.

The major research effort directed largely toward understanding resources on and in the immediate vicinity of the forests is the Chevelon Archeological Research Project. This project has been directed and co-directed in various years by archeologists from the University of California at Los Angeles, State University of New York at Binghamton, the University of Michigan, and Arizona State University: Fred Plog, Dwight Read, James Hill, Steve Plog, and Bruce Donaldson. Because the data assembled by participants in the project is fundamental to the conclusions reached in this plan, and because the data were collected in somewhat different ways and under different circumstances and research strategies, the project's history is described in some detail below.

The Chevelon Archeological Research Project began in 1971. During that year, the major effort was devoted to the obtaining of a statistical sample of the lands lying in the Chevelon Creek drainage, south of Winslow, Arizona. Most of the land in this drainage lies on the Apache-Sitgreaves National Forests. The sample unit used in the survey was a transect. Both 100 meters by 1 kilometer and 50 meters by 2 kilometers transects were used. Ninety-nine such transects were surveyed. In addition, four 1 kilometer by 1 kilometer quadrats were surveyed and a number of "study areas" defined by low density artifact scatters were explored. A total of 352 sites were recorded during this summer.

The problems on which we wished to focus during the second summer included both survey and excavation and necessitated a more restricted area. We sought a locality characterized by maximum temporal and functional variability. On the basis of the first summer's work, five such areas were identified. These were resurveyed to check the results of the first summer's work. On the basis of this analysis, a locality on the Apache-Sitgreaves Forests lying between Larson and Purcell Draws in the Heber Ranger District was selected. Because we wished to carry on survey and excavation concurrently, an initial sample of the locality was made. Transects 100 meters wide, running from Larson to Purcell Draws, were located every half mile between the boundary between the pine forest and juniper pinyon woodland transition on the south of the forest boundary on the north. On the basis of this sample, a decision was made to concentrate our effort in the southern portion of the locality. During the summer a roughly 3 square mile block was intensively surveyed as was a smaller .42 square mile block about half way between the northern and southern boundaries of the study area. In addition, a survey of Larson drainage was conducted to aid in understanding the distribution of water control features in the drainage. During this summer, 271 sites were located.

In the summer of 1973, the majority of the field work was excavation. However, a one square mile block lying between Purcell and Larson draws and against the northern boundary of the forests was surveyed. Thirty-two sites were inventoried.

The focus of our research shifted substantially in 1974. In a further effort to understand the nature of water control strategies in the area, a 2 square mile area lying along Brookbank Canyon was surveyed. In addition a transect sample of portions of the Heber and Pinedale Ranger Districts lying outside of the Chevelon drainage was made. As a result of these efforts, 185 sites were recorded.

Two projects conducted during the summer represented the first involvement of the Chevelon Archeological Research Project in explicit efforts to assist with the management of the forests' cultural resources. After a large fire south of Clay Springs the project surveyed portions of the burned area to assess: (1) the extent of disturbance/destruction of cultural resources that occurred as a result of the fire suppression effort, and (2) the extent to which the removal by fire of surface vegetation and pine duff may result in the discovery of sites that would otherwise be undiscovered. The second project was a cultural resources study of the White Mountain Planning Unit, between Pinedale and Lakeside, Arizona. Sixty-six transects were surveyed and 80 sites inventoried.

In 1975, research focused on the eastern edge of Pinedale District. A 2.5 square mile area in Bagnal Hollow was surveyed and inventory records completed for 108 archeological sites.

During the summer of 1976, attention shifted to the eastern end of the forest where survey of the eastern sector of the Little Colorado Planning Unit was undertaken (Plog 1978). A sample survey of the proposed Watts timber area was also done (Hantman 1976). A total of 105 transects and three .5 mile by .5 mile quadrats were surveyed. Information on 58 sites was recovered.

Survey during the summer of 1977 was in three different areas. First, the western sector of the Little Colorado Planning Unit was surveyed. Forty-five transects and three block areas were surveyed resulting in information on only seven new sites. A survey done to evaluate the cultural resource impact of the Left Hand Draw and Pinedale Timber Sales south of Pinedale resulted in information on 91 new sites (Lightfoot and DeAtley 1977). Finally, survey of a proposed juniper push area between Chevelon and Clear Creeks resulted in information on 31 sites (Hantman 1978).

During the summer of 1978, survey in the Pinedale area was extended to the Nick's Camp Timber Sale. Sixty-one new sites were located during the survey (Lightfoot 1978). At the western and eastern ends of the forests transects were surveyed to provide additional understanding of cultural resources and their distribution in these areas. Ninety-three new transects resulted in inventory records on 178 new sites. The purpose of this research was explicitly to complete transect coverage of the forests to allow completion of this document.

In summary, the history of the project has been a very complex one. From a financial perspective, the data in this study were gathered using funds from four separate grants from the National Science Foundation, with additional support from the University of California at Los Angeles, the State University of New York at Binghamton, the University of Michigan and Arizona State University (primarily for archeological field schools), and contracts and cooperative agreements with the Forest

Service. The goals that motivated each season's research were somewhat different, reflecting both the changing orientations of the field directors and our growing understanding of the cultural resources of the forest. At the same time, there have been important commonalities, if not identities in the field strategies employed during the various summers.

SURVEY STRATEGY

For several reasons, the survey strategy that was employed in 1971 was an innovative strategy in comparison with then-current standards. First, the surveying was done using an "intensive" investment of labor. Crew members were instructed to survey the ground surface walking between 10 and 15 meters from one another. While a few equally intensive surveys had been done previously (Ruppe 1966), surveys were also being done with crew members spaced as far as 50 meters from one another (Mueller 1975). The qualitative importance of the intensity of this effort cannot be overestimated. In the succeeding years, it has been demonstrated that the quantity of sites located varies directly with manpower investment and crew-spacing. At least 80% of the variation in site density from one area of the Southwest to another can be explained by variation in survey intensity (Plog, Plog, and Wait 1978). There are undoubtedly sources of variation in our survey data that we do not currently control. However, in comparison with other Southwestern surveys, the intensity of those done on the forests is among the very highest.

Second, the survey was done using a sample unit--the transect. Sample surveys had not been done in the Southwest previously, or rather, had not been done explicitly. When an archeologist surveys an area with crew members spaced 50 meters from one another, a transect survey is implicitly done. The biases of such an effort, however cannot be stated. The advantage of using a sampling unit such as a transect is that it makes possible the collection of very high quality data concerning small spatial units that are distributed over a large area. Such a data base is far more appropriate for generalizing about large areas than an equivalent amount of space at a single locus.

Third, transect locations were selected using randomizing procedures. Prior to this effort, areas were usually surveyed because one or more archeologists perceived there might be sites within the area in question. Three problems resulted. First, archeologists were left without a basis for contrasting locations that were utilized by prehistoric peoples with ones that were not. Second, the areas that were surveyed using this strategy were areas with relatively high site densities and potentially somewhat distinctive cultural resources. Finally, when an investigator fails to employ randomization or some other device for focusing attention on diverse cultural and environmental loci, selective biases are inevitable.

Fourth, the survey was based on a multistage design. Stage one involved surveying transects distributed over the study area at a ratio of roughly one per every six sections. These data were then used to map the apparent density of cultural resources in the area. A second sample was then done, based upon the density estimates: relatively more transects were surveyed in high density areas to increase recovery of information on sites in the area and relatively fewer were surveyed in low density areas, to check the earlier inference that densities were, in point of fact, low. The third stage involved the selection of three 1 kilometer by 1 kilometer quadrats within the survey area. While some modifications in this approach have been made, this has been the basic strategy used in every summer when survey of large spatial units was undertaken.

At the time this effort began, the use of transects, the use of statistical sampling procedures, and the use of multistage sampling designs were all experimental. In the intervening years the utility of this approach has been demonstrated in a variety of studies (Redman 1974; S. Plog 1976; DeBloois 1975; Stafford, Burton, Plog and Grove 1978), and it is increasingly used not simply in the Southwest but elsewhere in the United States.

There are, of course, problems with the data base that has been assembled. First, the surveys were conducted by different surveyors from different institutions and over a period of seven years. Undoubtedly, some changes in individual and group perceptions of both the nature of surface remains and their interpretaion, as well as the understanding of correct survey procedures, has changed in ways that we do not realize.

Second, and more importantly, the size and manner of locating transects has changed somewhat. Transect lengths have been 1 kilometer (.6 mile), 2 kilometers, 1 mile, and 1.4 miles. Widths have been either 100 meters, 50 kilometers, or 50 yards. The largest of the transects covers twice the area of the smallest. This factor will be taken into account in interpreting the density of sites on the forests.

Initially, the transects were located by randomly selecting a section and choosing a one degree bearing out of 360 degrees using a random numbers table. Reflection on this strategy led us to conclude we were engaging in methodological overkill: attempting to randomize observations in relation to archeological sites does not require precision on the order of 1/360th, or .003. We began, therefore, to locate tranects by choosing one of the directions described in the field strategy discussion earlier.

The discussion to this point has focused heavily on transect data, yet only a small minority of the sites currently recorded on the forests are known through this survey technique. The survey of large blocks and even moderatly sized ones was undertaken to understand the distribution of cultural resources over relatively small areas of the forests. In this sense, they are not particularly useful for generalizing about overall resource distributions. Nevertheless, these data will be used to check some of the conclusions drawn from the transect data. Similarly, they are of utility in estimating the total quantities of different sites represented on the forests.

In much the same vein, while excavated sites are useful in efforts to understand the relationship between surface and subsurface remains, the relation to distributional patterns is minimal. Information from the excavations, therefore, will be used primarily in adding descriptive detail to conclusions reached on the basis of survey information.

PREHISTORIC AND HISTORIC UTILIZATION OF THE FORESTS

PaleoIndian

Currently, there are no known PaleoIndian sites on the forests. The PaleoIndian occupation of the Southwest is variously described as beginning about 13,000 to 30,000 years ago. There are known PaleoIndian sites within a few dozen miles of the forests, and continual claims by amateurs of PaleoIndian manifestations in the basal deposits of some caves within the study area. One existing site record describes an isolated PaleoIndian point along the Mogollon Rim. Given the proximity of known sites, it is highly probable that PaleoIndian groups utilized the lands now lying within the forests' boundaries, however, confirming evidence is lacking at present.

Desert Culture

The Desert Culture stage in Southwestern prehistory lasts from about 7000 years ago until A.D. 1. The earliest such site in the vicinity of the forests is O'Haco rock shelter with a date of ca. 6000 B.C. in its basal levels (Bruier 1975). It is very likely that some of the rock shelters in the deeper canyons on the forests will yield similar dates, or would have had they not been cleaned out by pothunters. Other indications of a Desert Culture presence on the forests are a great density of lithic sites on small alluvial fans in the bottom of Chevelon and Wildcat Canyons and upland lithic sites throughout the area of the forests. Unfortunately, the interpretation of these data is highly problematical.

To date, we have had no success in attempting to distinguish between aceramic and preceramic sites. Preceramic sites are those left by occupants of the area prior to the time that ceramic vessels were being manufactured. Aceramic sites are sites that have no ceramic artifacts on them. The latter may conceivably be the product of peoples occupying the area after ceramics were made, but engaging in activities such as butchering or chipped stone tool manufacture that did not require ceramic vessels. That some aceramic sites are in fact preceramic is clear: one such site just off the forests, in the bottom of Chevelon Canyon, has a radiocarbon date of 900 B.C. There is, nevertheless, currently no basis for clearly separating aceramic and preceramic sites.

Pithouse Stage

From shortly after A.D. 1, until about A.D. 1000, Southwestern peoples were living in pithouses, structures built by lining a pit with timbers and mud. They were beginning to manufacture ceramic artifacts with increasing frequency, living in larger and more sedentary settlements, and relying more heavily on food production--growing corn, beans, and squash--than procuring food through hunting and gathering, which had been the principal strategy earlier. There is no area for the forests where the evidence for these peoples achieves the density that is characteristic of other areas of the Southwest. Evidence for the highest density in the Apache-Sitgreaves Forests of these earlier peoples occurs in the westernmost districts, especially the Heber and Chevelon districts.

Pueblo Stage

Pithouse dwellers did not simply disappear from the forests at about A.D. 1000. There is evidence of pithouse dwellers on and adjacent to the forests up until A.D. 1200 to 1300. Nevertheless, there is an even greater amount of evidence on the forests for peoples who built and lived in above ground masonry structures. There is suggestive evidence indicating there were more of these prehistoric than modern peoples on the forests and that the manner in which the prehistoric peoples organized their daily activities was quite complex--almost as complex as contemporaneous societies in the more developed areas of the Old World and clearly more complex than many other areas.

Protohistoric Stage

The protohistoric refers to the period of time from roughly A.D. 1300 until about A.D. 1700. It is very likely that the forests were the scene of considerable activity during this period, although the activities in question left little in the way of substantial evidence. During this stage, most peoples in the Southwest concentrated in areas such as those now occupied by the Hopi, Zuni, and the Rio Grande Pueblos. At the same time, Athabaskans, ancestors of the Navajo and Apache, were beginning to move into the vacated space, especially in higher areas such as the forests. Unfortunately, the nature of the protohistoric sites and our currently poor understanding of them leaves this particular stage as a highly problematical one.

Historic Stage

The beginning of the historic period in the study area is defined by the appearance of peoples with a written language who used that language to record the nature of their activities. Thus, while there was clearly a Spanish presence in the area well before A.D. 1700, that presence resulted in records that are inadequate for describing the nature of the activities that occurred. The first occupation of the area documented in writing to any substantial degree is the movement of Hispanic shepherds from New Mexico into eastern Arizona in the 1850s. More critically, in the 1860s and 1870s, intensive colonization of the area by Mormon settlers began. This colonization effort, although it was basically directed to areas adjacent to the northern boundaries of the forests, left substantial evidence there. The area was initially used for farming, however, sheepherding, cattle ranching, and eventually timber harvesting, came to be major economic activities in the area.

Modern Stage

There is no simple means of defining the point at which history stops and the present begins; therefore, a relatively narrow approach is taken, one based on material culture. The modern occupation of the forests is defined by material items, the production of which continues. Thus, pop tops are part of the modern record--they are still being deposited on the forests at a substantial rate. Narrow gauge railroads are historic features--they are no longer being constructed and represent a distinctive means of attempting to harness timber resources on the forests. Clearly, there are problematical material patterns in between.

NATURE OF CULTURAL RESOURCES AND IMPACTS

The various occupations previously discussed have left diverse evidence of past human behavior on the forests. Unfortunately, the field work done by the Chevelon Archeological Research Project has been sensitive principally to prehistoric resources. Thus, this description of resources on the forests is speculative in the case of protohistoric and historic materials, and areas said to be devoid of prehistoric sites may actually have historic sites.

PREHISTORIC CULTURAL RESOURCES

Low Density Artifact Scatters

Low density artifact scatters, commonly termed "non-sites" in the literature, contrast with "sites." Sites are discrete and interpretable loci of cultural materials. Low density artifact scatters lack the quality of discreteness and may also lack interpretability. They are relatively large areas characterized by a low density of artifactual materials, often less than one artifact in a ten square meter area.

Low density artifact scatters raise a number of management problems. They are often not adequately defined by sample surveys. Because of their size, a small sample unit such as a transect may pass through, but rarely includes, all of a low density artifact scatter. The impact of land modification activities on such scatters is not known. Since any patterning in the distribution of artifacts within such scatters exists at the level of dozens or even hundreds of meters, it is unclear that the integrity of these resources is impacted by any but the most extensive land modifying activities.

The interpretability of such resources, therefore, is unclear and it is also unclear whether they are likely to yield information relevant to understanding prehistoric utilization of the area. This problem arises because archeologists do not understand what patterns of human behavior generate these manifestations. They may be associated with purposeful behavior in exploiting resources in the vicinity or they may simply reflect the density of "traffic" through the area. Until such issues are resolved, the manner in which they should be integrated in management planning is unclear. Administrative studies to address this problem will be described later in this document.

Lithic Scatters

Lithic scatters are sites described by the presence of chipped and ground stone artifacts. Known sites of this type on the forests range from 1 square meter to over 1000 square meters. These sites do yield information important to understanding the forests' prehistory, although their precise interpretation is at present unclear. This difficulty arises from the two very different patterns of human behavior that generate such sites. As mentioned earlier, prior to approximately A.D. 1, Southwestern peoples did not manufacture ceramic artifacts, therefore, the sites reflecting their presence are almost exclusively lithic sites. Even after Southwestern peoples made and commonly used ceramic artifacts, some of their activities were carried out at loci where ceramic items were not a necessity--butchering and hunting camps are examples. Differentiating these two behavioral patterns is extremely difficult, and analyses undertaken to date have proven unsuccessful (Slawson 1978). Nevertheless, archeologists in other areas of the Southwest have begun to achieve some initial success in resolving the problem using techniques that have not as yet been tried on the forests. Therefore, the sites have potential value and should be protected.

Ceramic Scatters

Ceramic scatters are defined by the exclusive presence of ceramic artifacts. In general, the presence of ceramic materials allows assigning at least a rough date to such manifestations. The sites are generated by prehistoric human activity that involved the exclusive use of ceramic containers. Such containers were used for cooking, for the storage of water and for the storage and processing of foodstuffs. They may also have been used as boundary markers for the fields or lands associated with a particular settlement. Such sites, then, provide evidence concerning a number of different activities in which prehistoric peoples engaged. They do yield information important to understanding past human behavior on the forests and should be protected.

Artifact Scatters

Artifact scatters are defined by the presence of ceramic and lithic artifacts. These sites are generated by four distinctive patterns of human behavior. First, they are produced by resource extracting behavior, the use of chipped and ground stone and ceramic artifacts in collecting resources at a particular locus. Second, they are generated when a locus is used for habitation but the habitation structures were of so ephemeral a character that they leave no surface evidence. Third, they are generated when permanent habitation structures are obscured by later natural and cultural transformation processes. Fourth they occur when a locus has been reused, over time, by peoples having different artifact inventories. Preliminary analyses indicate that the majority of these artifact scatters on the forests are associated with activities other than habitation since their artifact inventories are distinct from those of habitation sites (McAllister and Plog 1979). Thus, such sites do yield evidence important to the understanding of local prehistory and should be protected.

Petroglyphs/Pictographs

Petroglyphs are drawings made on rock surfaces by pounding those surfaces with a hard instrument to create a pattern. Pictographs are made on rock surfaces using pigments. There are known petroglyph sites on the forests (Figure 3) and pictograph sites immediately adjacent to the forests. These sites reflect ceremonial, or simply aesthetic, expressions or the efforts of

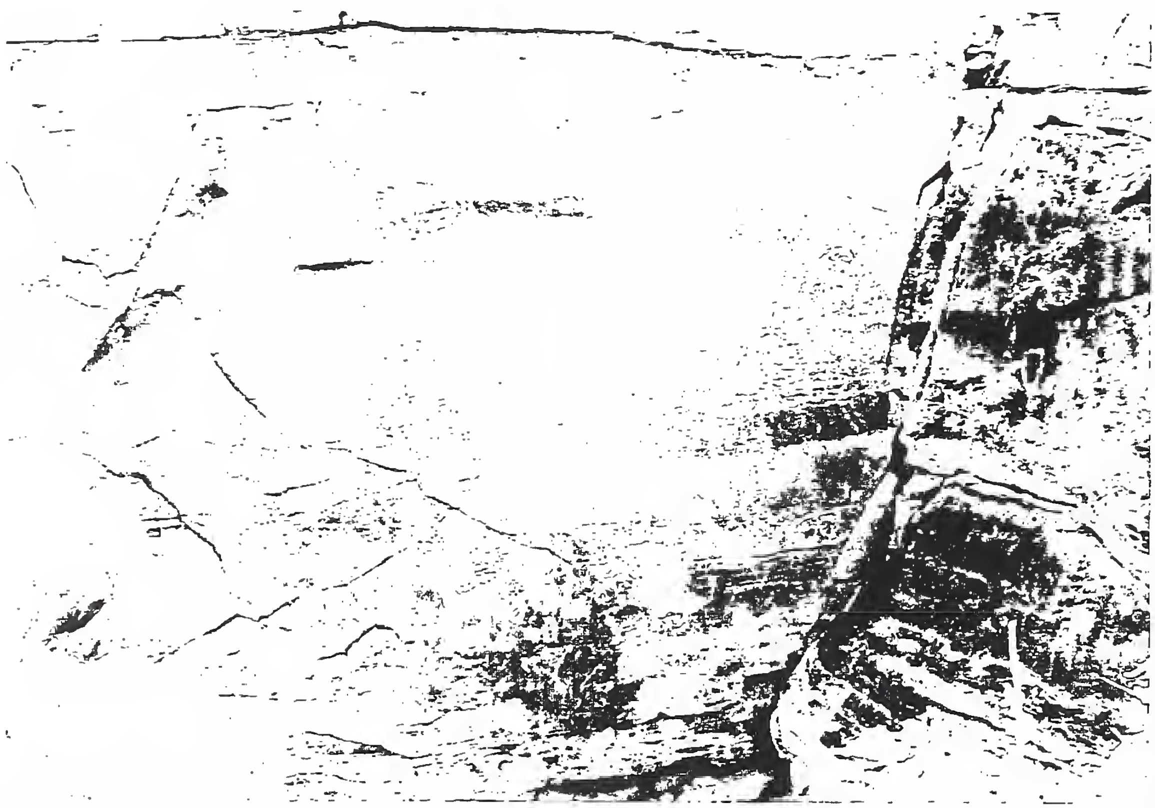


Figure 3. A petroglyph panel illustrative of those occurring on the forests.

prehistoric peoples to communicate with one another. Some scholars argue that these sites can be dated while others argue that the drawings are interpretable. That the sites can yield valuable information is indicated by one glyph in the vicinity of Chavez Pass Ruin on the Coconino Forest.

This glyph is a representation of Quetzalcoatl, a Meso-American god. In this instance the particular representation of Quetzalcoatl is one that is sacred to stone workers. This discovery illustrates the possibility of drawing symbolic connections between peoples of different areas using the rock art. In this and other senses, petroglyphs and pictographs yield information important to understanding prehistoric behavior in the area and the sites should be protected.

Since such manifestations typically occur on cliff faces or on vertical cliffs, only the very most extensive land modifying activities are likely to impact them. A more likely source of impact is their growing value in the illicit antiquities market. In the Salt River Valley, whole panels of glyphs have been removed for private collections or sale. Within the near future, the value of these items will justify finding and stealing glyphs as far away from population centers in the state as those on the forests.

Water Control Devices

Southwestern peoples used reservoirs, irrigations ditches, terraces, gridlines, and check dams as mechanisms for water and soil control. Examples of both terraces (Figure 4) and grids are known from the forests. Terraces were constructed by placing rocks on top of one another to a sufficient height that the land surface behind the terrace could be leveled. Gridlines are also lines of rock, usually only a single course in height, aligned to closely follow the contour of a surface. Contour plowing is a closest modern analog of gridding. Check dams are defined by

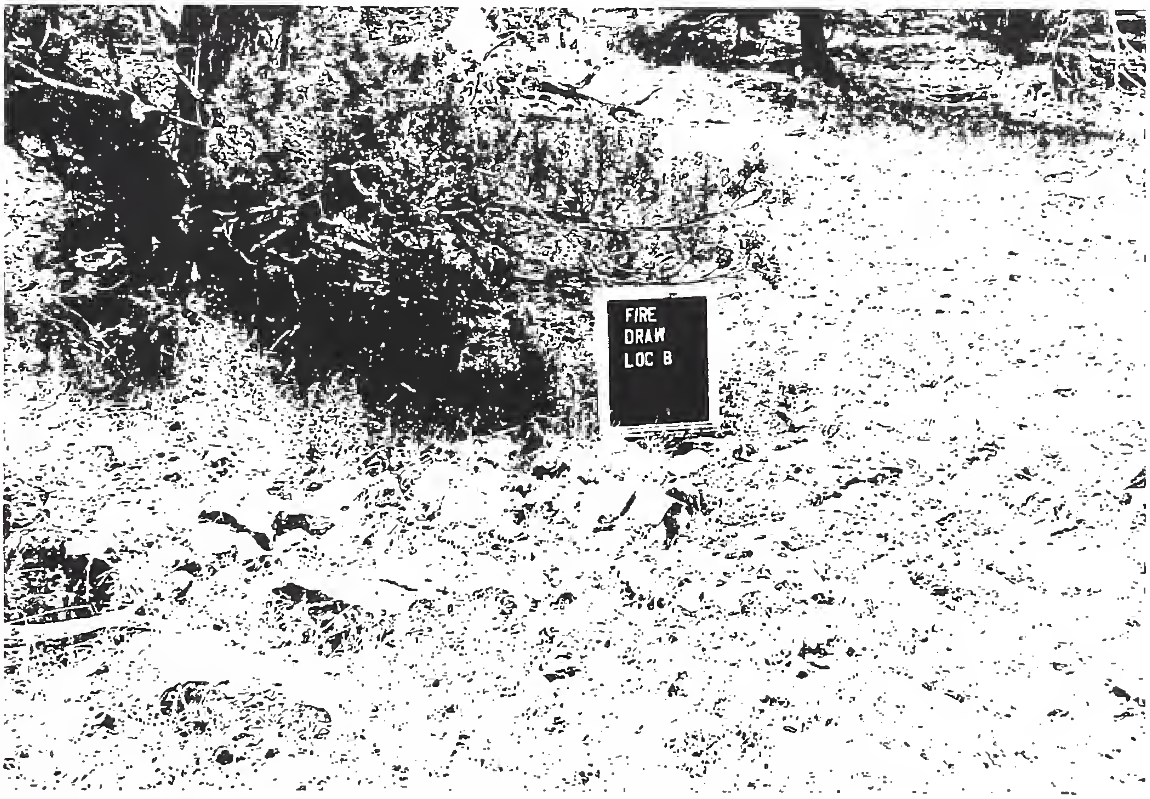


Figure 4. Part of a terrace system.

rock alignments, usually one but sometimes more courses in height, placed across stream channels perpendicular to the flow of the stream. These served to slow the flow of water through the channel, reduced erosion by capturing soil suspended in the stream water, and increased the level of ground moisture in the channel. There are currently no known examples of prehistoric irrigation ditches or reservoirs on the forests.

There are, however, irrigation ditches immediately adjacent to the forests and they may well be found on the forests once the site inventory is more complete. Water control features are important to understanding the subsistence practices of prehistoric peoples and, therefore, should be protected.

Shrines

Shrines (Figures 5-8) are a category of cultural resources the definition of which is somewhat of a problem. They are normally defined by low stone walls enclosing a circular or quadrilaterial area on the order of one or a few square meters. A shrine may consist of several such arrangements. Beads, ceramic and chipped stone artifacts and a variety of esoteric materials may be associated with shrines. On the forests, shrines occur at high altitudes--on mountain peaks and overlooking the headwaters of major drainages. As shrines yield information important to understanding the ceremonial behavior of prehistoric and modern peoples, they should be protected.

Rock Shelters

The earliest "roofed space" that existed on the forests was a rock shelter, an erosional cavity in a cliff face that was used for perhaps occasional, perhaps permanent, human habitation. The most common occurrence of these features is in the larger and deeper canyons, Chevelon, Wildcat, and Brookbank, but they are also found elsewhere on the forests. These sites represent particularly important cultural resources because they often contain stratified deposits that yield information concerning changes in prehistoric behavior through time. Also, materials such as basketry and cloth, not normally preserved in open sites, are preserved in rock shelters. This last characteristic of the sites has made them a prime target of pothunters. The majority of such sites on the forests have been disturbed and some have been vandalized to the extent that no cultural deposits remain at all. Those that do have some artifacts left have been so badly mixed that they can no longer be used in interpreting past behavior. The need for identification and protection of the remaining sites is, therefore, especially urgent.

Pithouse Sites

Prior to about A.D. 1000, most habitation or living sites occupied by Southwestern peoples were pithouse villages. Pithouse is a term that covers a multitude of phenomena. Some Southwestern pithouses are only a few dozen centimeters in depth while others are over two meters. Nevertheless, with rare exceptions, pithouses were built by erecting timber supports in a deep or shallow pit, laying branches and/or reeds against these to form walls and roofs, and covering these with dirt or adobe. Pithouse sites are difficult to identify, especially when the houses in question were relatively shallow. The presences of houses is indicated by some combination of circular to rectangular depressions, vegetation patterns, patterns marked by the absence of vegetation, and/or configurations of wall stones or cobbles. Pithouses can be present on sites without any substantial surface indications. They yield information that is important in understanding the organization of prehistoric settlements, patterns of social stratification, and the nature of activities that were carried out at village sites. They should, therefore, be protected.

Pueblo Sites

Pueblo sites (Figures 9-15) are defined by evidence of above-ground masonry architecture. These sites are characteristic of Southwestern peoples after about A.D. 1000, although there is substantial evidence that some peoples residing on the forests continued to live in pithouses well after this date. Pueblo architecture on the forests is markedly diverse. "Field houses" (Pilles 1979) are marked by a

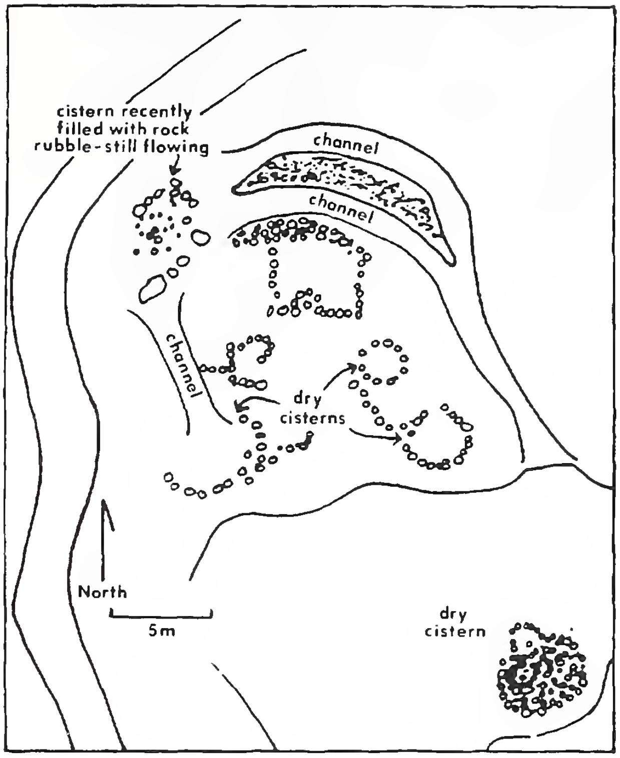


Figure 5. AR-03-01-01-22. AZ W:4:1 (ASU) Bead Spring.

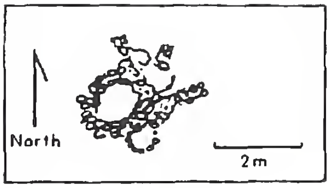


Figure 6. AR-03-01-01-23 AZ W:4:2 (ASU) Escudilla Peak Shrine.

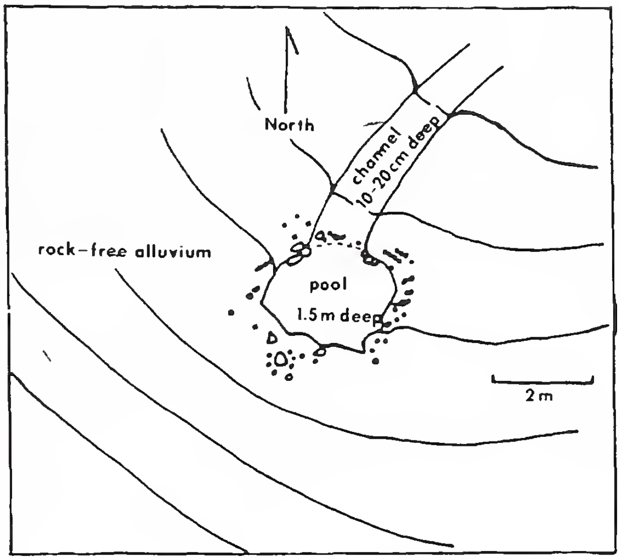


Figure 7. AR-03-01-06-11. AZ Q:15:1 (ASU) Point of the Mountain Spring.

(All Figures on this page are after Wood 1978).

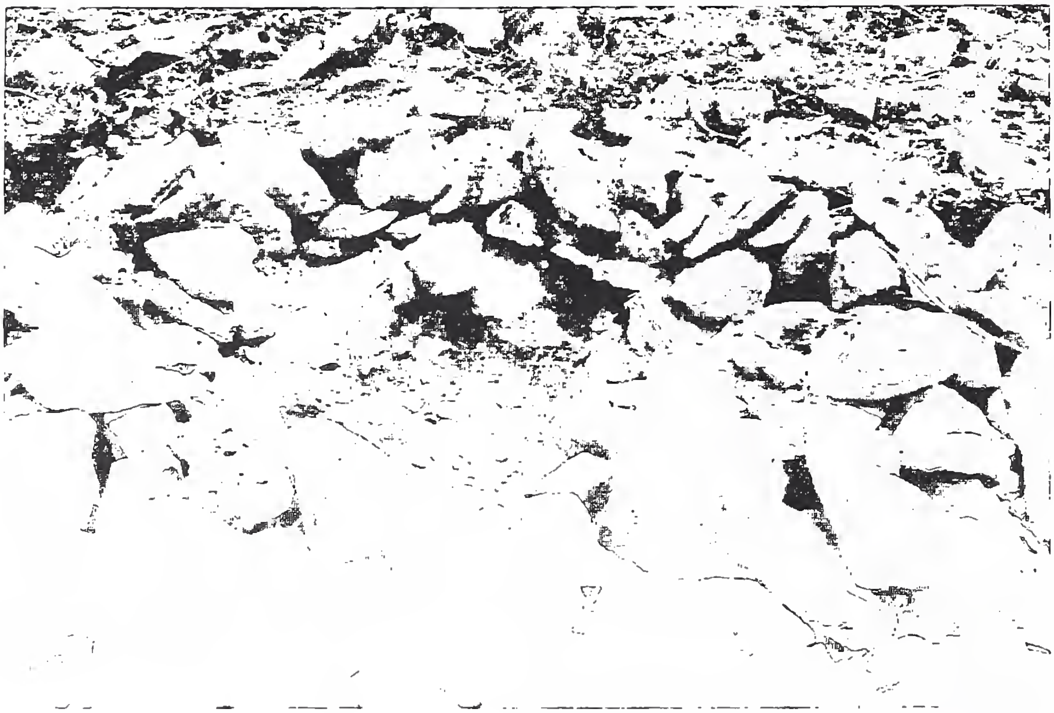


Figure 8. A portion of Bead Spring shrine.

Figure 9. Surface evidence of a poorly-defined U-shaped structure.

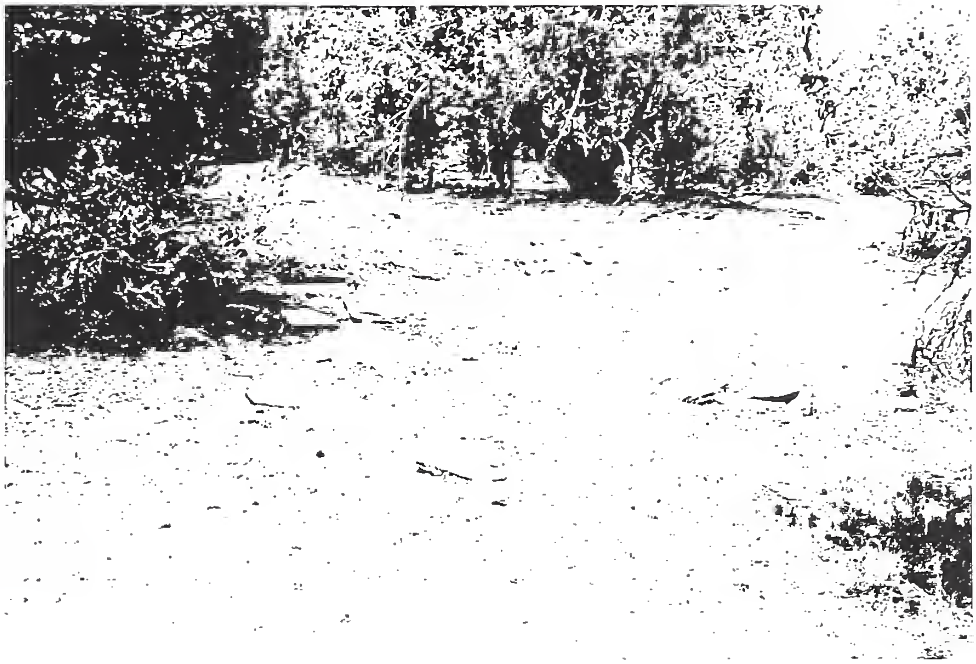


Figure 10. Surface evidence of a well defined, U-shaped structure.

Figure 11. U-shaped structure after excavation.

Figures on this page are after Wood 1978.

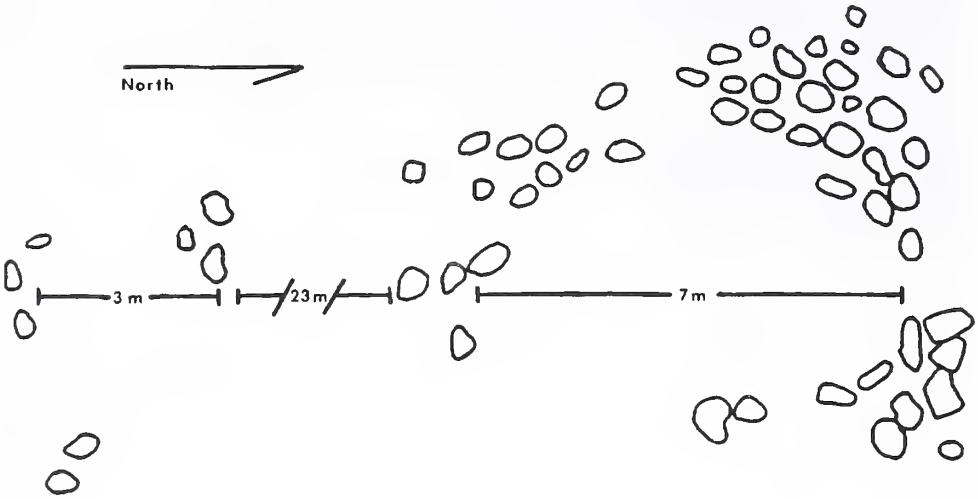


Figure 12. A typical one-room, U-shaped structure.

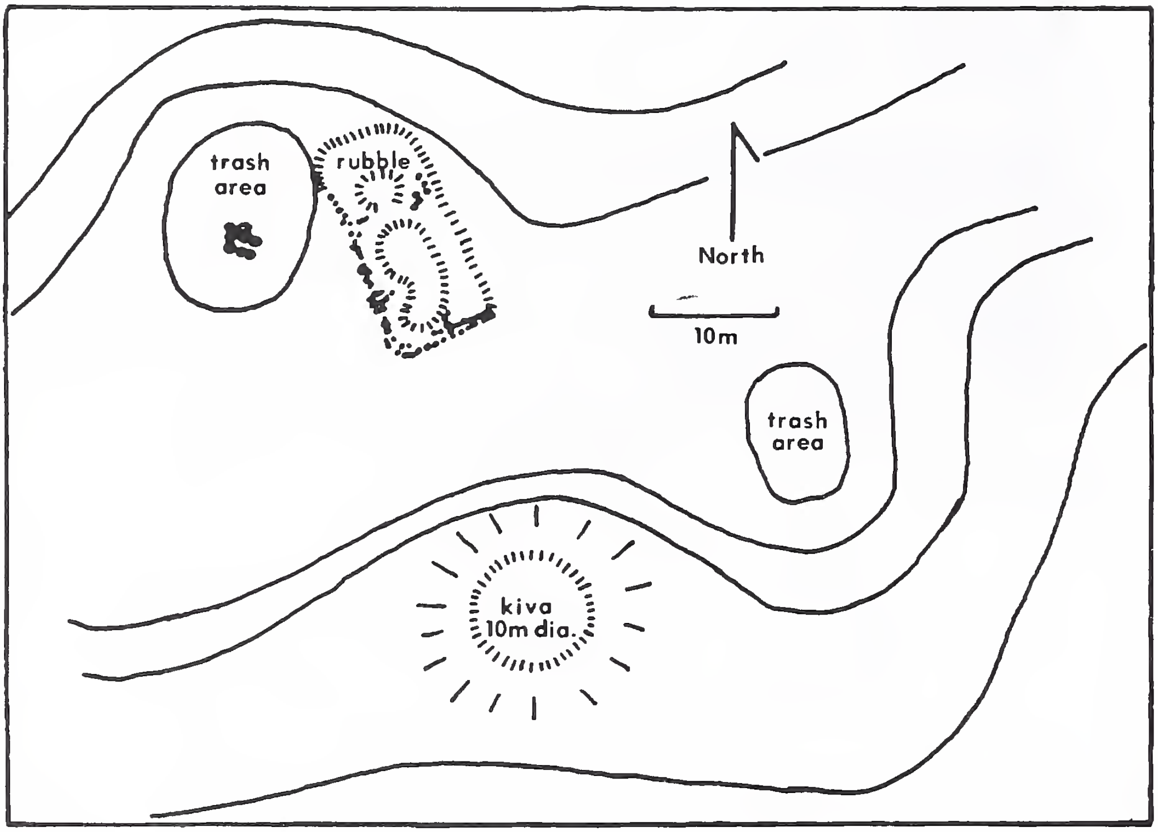


Figure 13. Sketch of site AR-03-01-06-14, AZ Q:15:4 (ASU).

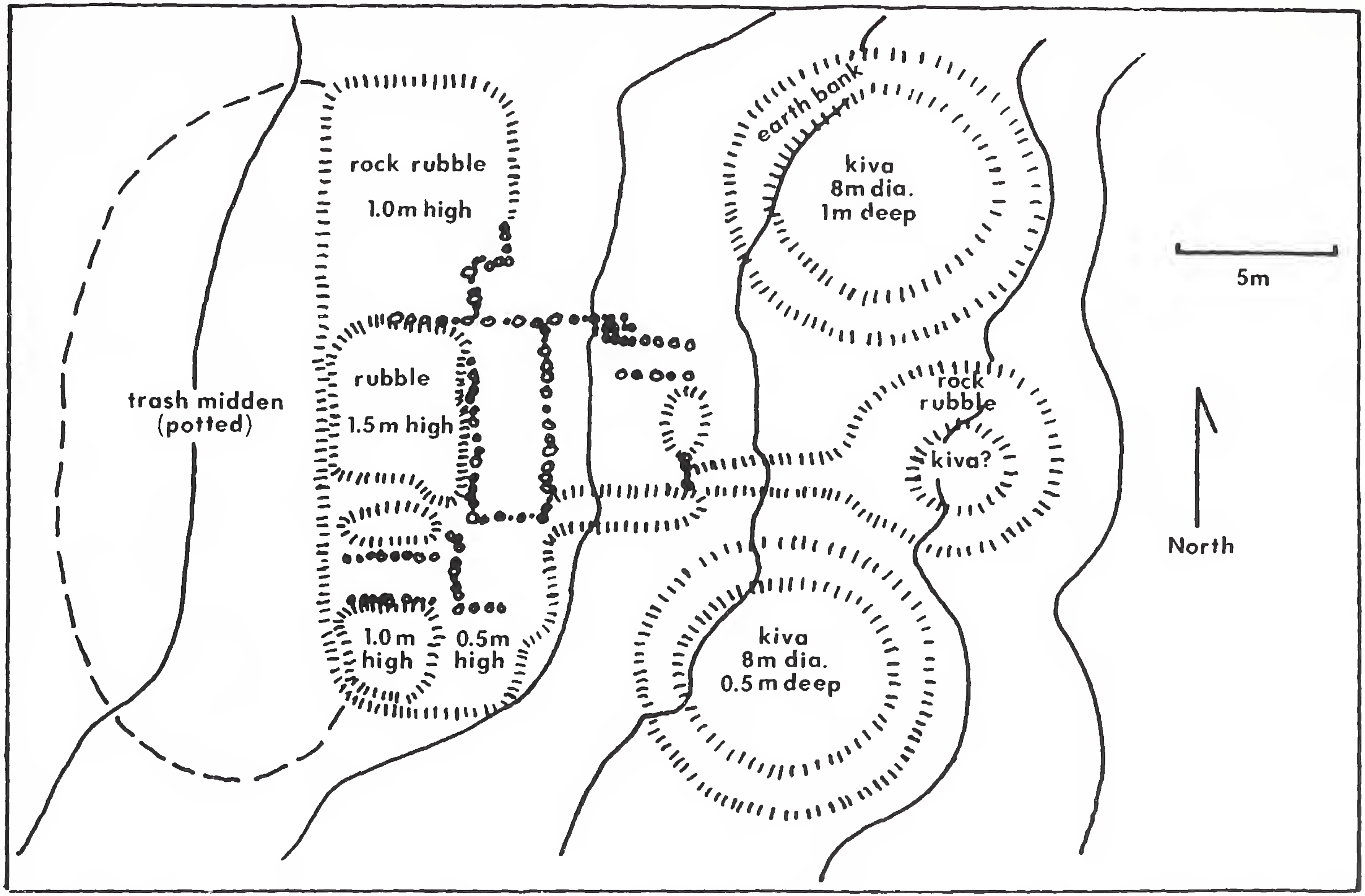


Figure 14. Sketch of Site AR-03-01-06-13, AZ Q:15:3 (ASU), after Wood 1978.

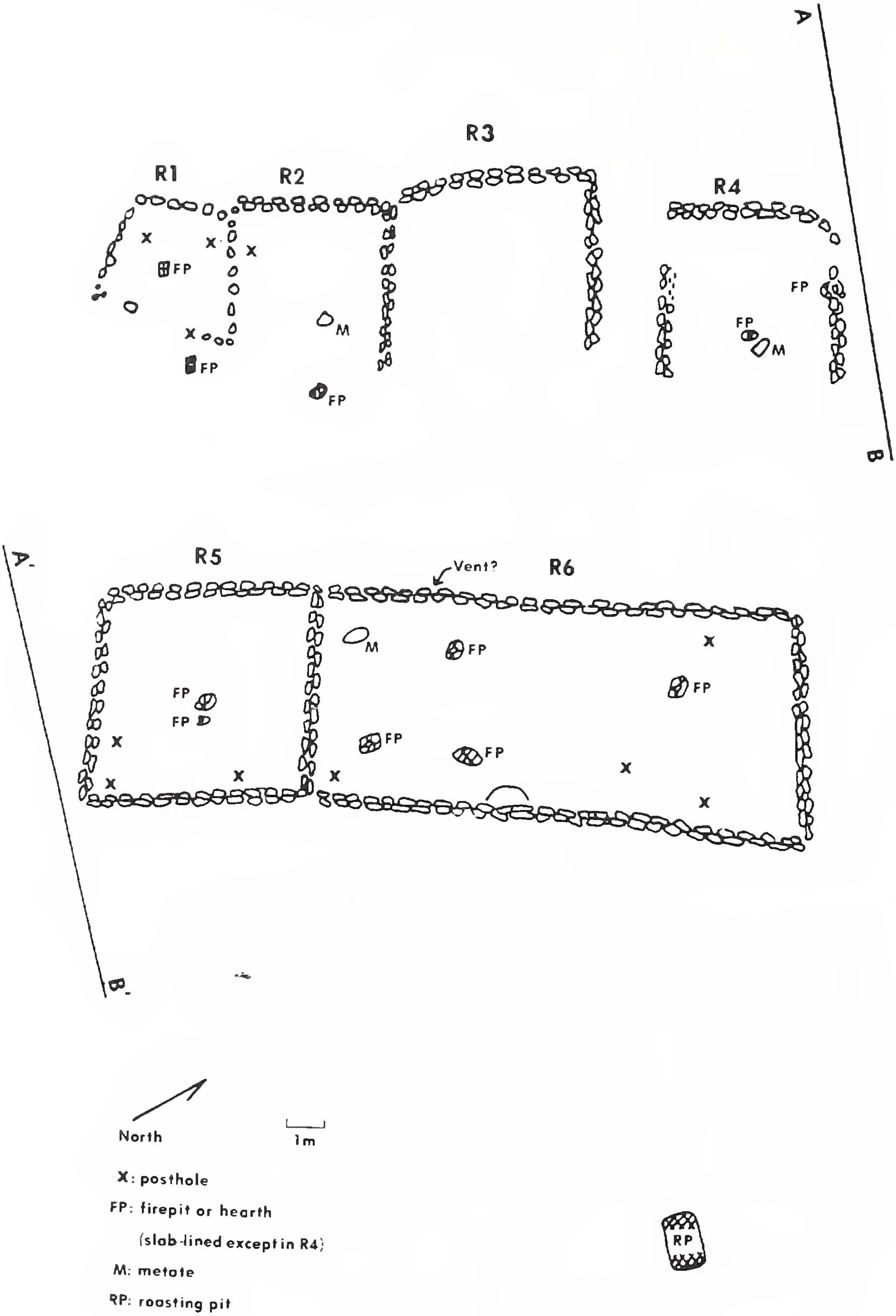


Figure 15. CS-731 At this one relatively complex site, a variety of architectural styles occur.

simple pile of boulders covering an area of several square meters. The associated artifact density is typically quite low. These structures were probably used seasonally in association with plant cultivation activities in fields. Small U-shaped structures of one or two rooms are characteristic over the western half of the forests. The artifact density associated with these structures suggests that occupation at the sites, or at least the production of artifacts, was far greater than at field houses. True "pueblo" architecture has four full standing walls. These sites also typically average about two rooms. Their artifact inventories suggest, however, that they may have played a distinctive role in trade or exchange relationships within the area. While both U-shaped and true pueblo sites are typically small, there are larger examples. The largest known site of U-shaped structures has roughly 40 rooms and the largest true pueblo has about 200 rooms. These sites yield information that is critical for understanding the organization of puebloan peoples and the nature of activities carried out at their living sites. Unfortunately, next to rock shelters, they are the most likely class of sites to have been impacted by pothunters.

Great Kivas

Great kiva sites are defined by the presence of large (ca. 15-25 meters), usually circular depressions. These sites represent the centers of ceremonial activity among prehistoric peoples on the forests. Great kivas sometimes occur as features on pueblo sites, but they also occur in total isolation on the forests. While their principle importance was ceremonial, these sites also seem to have served as important centers of exchange and trade on the forests. Because they are likely to yield information important to understanding economic, as well as ceremonial behavior, these sites should be protected.

Compounds

Compounds (Figure 16) are a completely enigmatic site type. They are defined by substantial masonry walls enclosing rectangular areas between approximately 30 to over 100 square meters. The artifactual assemblage of such sites is generally quite different from that of contemporaneous sites, although the manner in which such sites differ is highly variable. While

Figure 16. Rubble mound marking the wall of site 470, a large compound site.

Table 1. Description of Prehistoric Site Types Found on Transect Survey

	BLUE RIDGE	CHEVELON	HEBER	PINEDALE	LAKESIDE	SPRINGERVILLE	ALPINE	TOTAL TRANSECTS	TOTAL PROJECTED STUDY AREA
Surface habitation structures Pueblo									
1 room	5	5	18	9	1	2		40	1731
2-5 rooms	8	7	24	15	6	9	4	73	3159
2-5 rooms, with kiva			1	1				2	87
6-9 rooms		1	2	3	4	1		11	476
6-9 rooms, with kiva			1					1	43
10+ rooms			3	1			1	5	619
unknown number of rooms			2	1		1		4	173
Pithouse structures									
1 room		2	2	6	3	2		15	649
2-5 rooms		2	1	5	1	1		10	433
6-9 rooms				1				1	43
Combination of surface and pithouse structures		1	1	4	1			7	303
Artifact scatters									
1-9 square meters			2		2			4	173
10-99 square meters		3	8	12	4	1		28	1211
100-999 square meters	3	19	26	33	6	2	1	90	3894
1000+ square meters	2	7	6	4		1		20	865
unknown square meters			1	5				6	260
Lithic scatters									
1-9 square meters		1						1	43
10-99 square meters			3	3				6	260
100-999 square meters		3	2	5	3	1		14	606
1000+ square meters	1			1		1		3	130
unknown square meters				1				1	43
Ceramic scatters									
1-9 square meters		1	1					2	87
10-99 square meters		1	4	1		1		7	303
100-999 square meters	1		4					5	216
Water control features		8	9	2				19	822
Kivas, alone		2	2		1			5	216
Rock ring or amorphous rock structures		7	4	1			1	13	563
Petroglyphs			1					1	43
Historic	1		1			1		3	130
Rock shelters			5					5	216
not enough details			5	1	1	7		14	606

their precise role in regional settlement systems is currently unknown, they too apparently served as centers of trade and exchange within the region of the forests. For this reason, they are likely to yield information important to understanding prehistoric human social organization and should be preserved.

The relative quantities of the described sites as they are known from the transect survey are shown in Table 1.

HISTORIC CULTURAL RESOURCES

As noted earlier, the nature of the survey data on which this document is based is less sensitive to historic than prehistoric cultural resources. For this reason, the discussion of historic resources is more general than that for prehistoric resources. The diversity of such resource is, nevertheless, great. The subsistence and economic practices of the historic inhabitants of the area is as diverse, if not more diverse, than those of prehistoric peoples. Prior to Anglo settlement of the area, native American groups used the area for hunting and gathering and possibly for agriculture. Early Anglo settlers were involved in farming and sheepherding, which were eventually replaced by cattle ranching, lumbering, and tourism. Each of these distinctive activities would have produced somewhat different sets of cultural resources. These resources are currently neither located nor described, therefore this discussion focuses on the kinds of resources that might have been generated by various activities.

Protohistoric Cultural Resources

Immediately prior to white contact, native American groups probably made occasional use of the forests. First, the animal and plant resources of the forest would have been a likely source of foodstuffs for Apachean groups. Secondly, the area could have been used by these same peoples for cultivation. Finally, trade routes between Puebloan and Apachean groups would certainly have passed over the forests. These activities would have generated a number of cultural resources including:

1. Temporary camps
2. Fields
3. Ramadas or shades used as field houses
4. Sweat lodges
5. Storage pits
6. Mescal or other pits used for food processing.

Historic Cultural Resources

Military

The earliest Anglo presence in the area would have been a military presence in the form of both exploration and military campaigns, against native Americans. Since the intensity of military activity in the area was minimal, the visibility of cultural resources left by this group would not be great. Crooks Military Road, for example, might be marked by occasional camp sites, but the notion of a continuous artifactual distribution that might mark such a road is nonsensical. At the same time, the artifactual inventory carried by the military is not that distinctive from other Anglo groups that might have moved across the forests at the same, or at a later, time. Even blaze marks are non-diagnostic since later peoples could easily have copied earlier symbol systems. Nevertheless, the following types of sites could be present:

1. Forts
2. Temporary encampments
3. Trails
4. Battlefields
5. Blazed trees
6. Roads.

Settlements

A number of early settlements on the forests are marked now by the remains of a few buildings or by still less substantial evidence. In some instances only especially dense artifact concentrations mark the location of the settlement, nevertheless, the following structures once marked such loci:

1. Houses
2. Outhouses
3. Barns
4. Corrals
5. Public buildings--schools primarily
6. Trading posts
7. Graveyards.

Farming

The earliest settlers of the forests attempted to become self-sufficient subsistence farmers. This goal was never achieved as foodstuffs from lower lying communities and from as far away as Utah were necessary for survival in the area. Apart from facilities associated with settlements, irrigation ditches, once-plowed field zones, and fence lines might define the existence of such settlements. It is likely, however, that most such evidence would have been destroyed in the intervening periods since modern peoples continue to use and modify many locations initially occupied during the historic period.

Sheepherding

For a period of time, sheepherding was the major economic activity on the forests. To the extent that sheepherding was done from permanent settlements, evidence of this activity would duplicate that of others. Distinctive indicators would include the following:

1. Sheep crossings
2. Temporary camps
3. Sheep dipping vats
4. Sweat houses
5. Water troughs.

Ranching

Ranching is an activity that continues in the area today. A number of features might be generated by this activity:

1. Ranch houses
2. Barns
3. Corrals
4. Outhouses
5. Temporary camps
6. Line shacks (Figure 17)
7. Fence lines.

Lumbering

This activity also continues in the area today. The technology is now distinctive from that of several decades ago, however. The following categories of evidence would be useful in elucidating those differences:

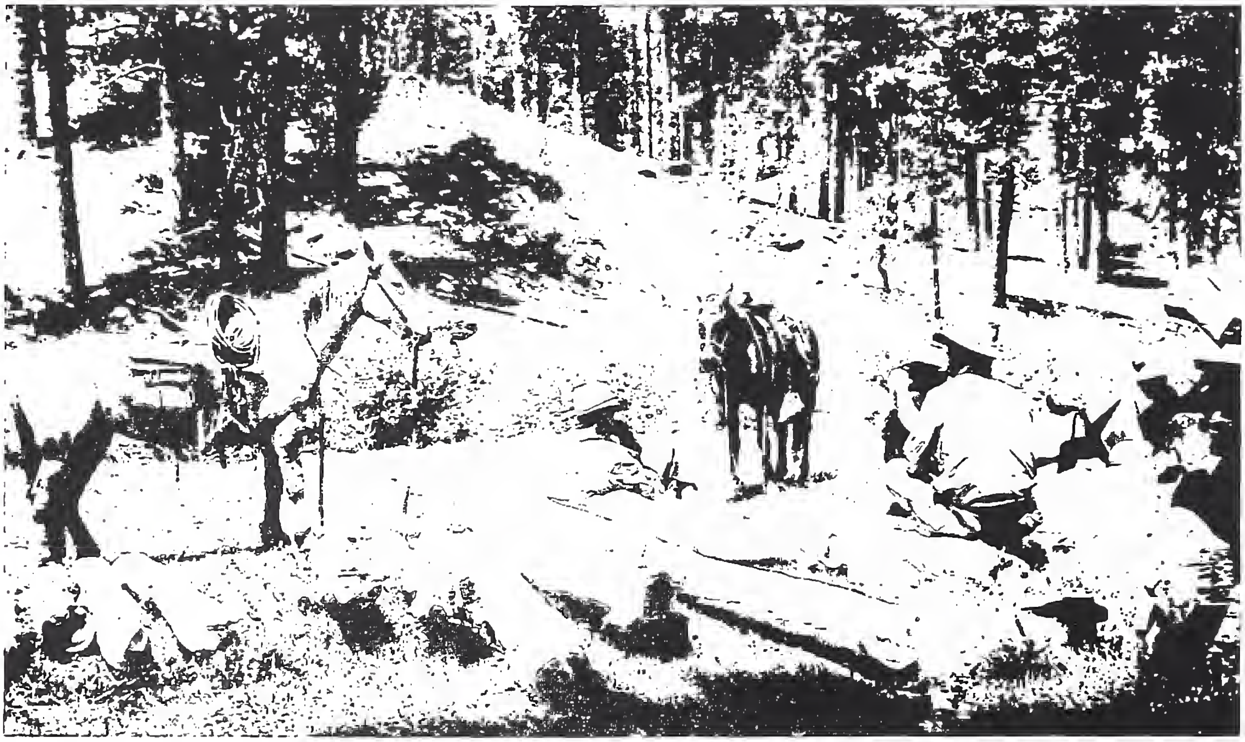


Figure 17. Stockmen and ranger at old Gentry Cabin, Chevelon Ranger District, May 1934

1. Lumber camps
2. Landings
3. Railroad beds
4. Sawmills.

Forest Service

One of the distincitive cultural resource sets of the forests is that created during the early history of the Forest Service in the area. Old lookout towers (Figure 18), line camps, and ranger stations (Figure 19, see also Bates 1978, Figure 5) are important in elucidating the changing management of the area by the agency.

Interactive Patterns

Roads, trails, and telegraph lines found on the forests reflect the pattern of traffic among the major settlements of past periods. These can be used to study the nature of changing interaction among communities that occurred as settlements grew and died, and the economic patterns on which they were based waxed and waned.

This discussion has focused on major features rather than distinctive artifacts. The reason for not focusing on artifacts is the substantial overlap of material items involved in the different activities. Clearly, even the features lack complete distinctiveness. This is even more the case for artifactual materials and only detailed studies will bring our understanding of variable material patterns to a point where these can be used in differentiating the activities in question.

NATURE OF IMPACTS

There is no question that the most effective means of preserving cultural resources on the forests would be to stop all road building, grazing, timber harvesting, and recreational activities on them. However, these lands are National Forests and not National Parks and such a strategy would violate not only the multiple use philosophy that guides land use decisions on the forests, but also the principle of establishing the relative value of archeological resources in relation to others, and, finally, common sense. A realistic approach to the impacts created by other land use activities is one that: 1) seeks to understand the nature of impacts associated with specific activities undertaken on the forests, and 2) seeks to prevent or minimize those impacts. This section considers the nature of the impacts associated with different activities.

General

There is no question that the greatest single source of potential impact on cultural resources is a simple lack of awareness of those resources. While there is no way of documenting this argument, one must seriously question whether specific land modifying activities have had nearly the impact on cultural resources than that resulting from a simple failure to be aware of the need to protect them. The casual destruction of sites and the casual removal of artifacts from site surfaces by forest personnel, contractors, and the general public has in all probability had a greater effect on the quality of existing resources than the aggregate of land modification activities that have occurred there. Having raised this particular issue as a general one, it will not be addressed in the succeeding section. Means of increasing employee, contractor, and public awareness are discussed later.

Timber

The greatest impact arising from timber harvest is the construction of haul roads and landings. The movement of heavy equipment across the ground surface and the skidding of trees are a second potential source of direct impact. These impacts may occur to cultural resources, both on and below the surface.

Another impact is fuelwood harvesting. While this activity has always occurred on the forests, it promises to increase in importance in the future. Potential direct impacts of the activity are the movement over cultural resources of vehicles as they travel to cutting sites. Potential indirect impacts are increased pothunting and collecting from sites as a result of increased human traverse over the forests.

The first impact is best resolved by actually surveying road and landing locations and realigning them, if necessary, to avoid sites. In this fashion, the costs and

Figure 18. Promontory Fire Tower, Sitgreaves National Forest, September 1928.

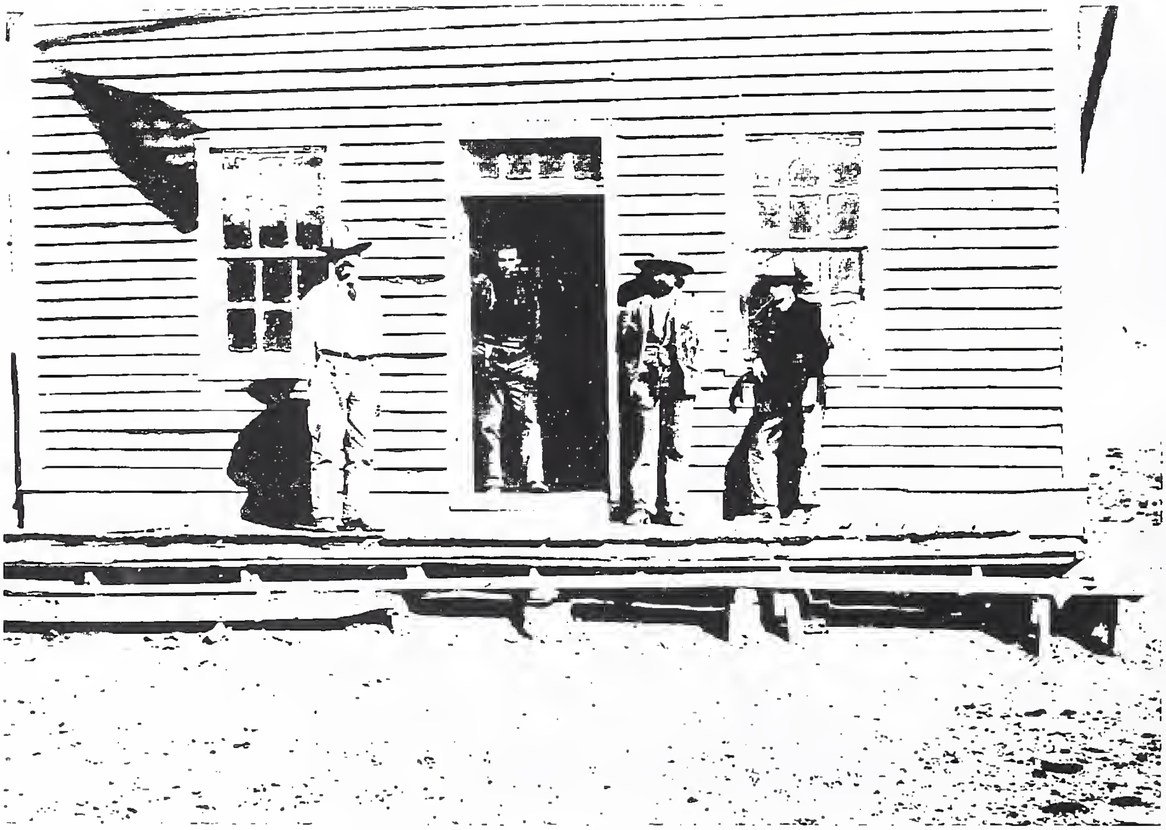


Figure 19. Forest Supervisor's Office Springerville, Arizona, Winter of 1908-09.

problems raised by conspicuous flagging of sites can be avoided.

Management of the fuelwood impact is difficult to assess. Flagging will only serve to increase the visibility of archeological sites. Initially, the best approach appears to be distributing information to all permittees warning them of the laws concerning cultural resources and describing the importance of those resources as well as periodic monitoring of fuelwood areas.

Other impacts are best resolved by prior survey of the area that is to be harvested and flagging cultural resource locations so that the harvesting of trees or the movement of equipment through them can be avoided. As currently practiced, this approach has two negative side effects. First, it advertises the location of cultural resources to anyone passing through the area. Second, the flagging is frequently done so far in advance of the sale that many of the boundary markers have disappeared prior to the harvest. Technological means for resolving this problem potentially exist in the form of alternative site markers. Stores and libraries are beginning to use small chips placed in merchandise or books that amplify a transmitter signal. The use of such chips embedded in a site tag or a nail could be used to mark a site. The time required to return to a site and flag its boundaries immediately prior to harvesting in the area would be greatly reduced. Similarly, the flagging should be removed immediately after completion of the sale, with the tag remaining as a permanent indicator of the presence of a cultural resource.

Range

Three activities of range management may impact cultural resources: juniper clearance, fence construction, and the construction of stock tanks. The first of these impacts is potentially the most damaging. The movement of heavy equipment through an area and the disruption of subsurface deposits when large trees are removed are the sources of destruction. These impacts have been largely avoided in recent clearance activities by prior survey and flagging of cultural resources. While there is potential for the same problems with flagging that arise in timber harvesting, the time lag between the cultural resources survey and the clearance can be greatly reduced. Again, the flagging should be removed after the activity has been completed.

An indirect impact of juniper clearance is increasing the visibility of cultural resources. A few early efforts to protect cultural resources resulted in tree zones around them that virtually identified the existence of the resource. Incorporating the cultural resources into vegetative screens that are left to minimize the impact of clearance on the aesthetic qualities of an area as well as its quality as a wildlife habitat will also serve to protect the cultural resources there.

Fencing potentially has both direct and indirect impacts. Survey in advance of actual construction is not always warranted since the actual zone of disturbance may not be great. However, at least one individual able to identify cultural resources should be a member of the construction crew. An indirect impact of fencing is the use of fence lines as a trail through the forest. To the extent that hunters and hikers use the fence lines they will be attracted to nearby archeological sites and casual collecting may result. Animal traffic also increases the likelihood of impact to sites along fence lines. Thus, when a fence line is moved around a cultural resource it should be moved a sufficient distance that the resource in question is not visible from the fence line.

Because stock tanks are isolated points, minimizing their impact is relatively simple. As long as the site and the means by which heavy equipment will be moved to the site are inspected, direct impacts are easily avoided. The indirect impact resulting from the construction of a stock tank is the concentration of cattle in its vicinity. Site surfaces can be disturbed to a point where materials can no longer be analyzed when those surfaces are repeatedly trampled by livestock. Therefore, stock tanks should generally (a) not be located in zones of exceptionally high site density, and (b) not be located in the immediate vicinity of an archeological site.

Engineering

Apart from their role in the activities just discussed, the major impact of engineering is the construction of roads. The direct impact of road construction is the disturbance of the ground surface. Careful survey of proposed roads prior to construction is, therefore, warranted. To the maximum extent feasible, actual flagging of sites should be avoided for the reasons discussed earlier. The major impact of roads is opening public access to areas where cultural resources are dense. The major impact that enhanced access has had on cultural resources is discussed elsewhere in the report. Roads are necessary and some of these impacts are unavoidable. But they can be ameliorated by: 1) avoiding road construction in areas of exceptionally high site density to the maximum extent feasible and, 2) either leaving vegetation that screens cultural resources or revegetating in a manner that screens the resource from traffic moving on the road. When improving existing roads it is important to remember that some features of the historic road e.g., a unique bridge, may be worthy of perservation.

Fire

The potential impact of fire supression on cultural resources is substantial. Stories of fire crew members removing artifacts from sites and direct evidence of the destruction of cultural resources abound in the case of the Day Burn, a recent fire that occurred in an area of high cultural resouce density. Whenever possible, it is advisable to have one or more archeologists present during fire suppression to reduce the impact of the activity on cultural resources to the degree feasible given the more immediate and pressing concerns of fire supression. It is especially important that the sensitivity of temporary summer personnel to cultural resources be increased to prevent both casual and major destruction of cultural resources.

Recreation and Lands

The primary direct impact of recreational activities is the construction of camp sites. In general, these sites increase access to cultural resources. The magnitude of the problem created by that access is difficult to estimate, but it may be substantial. Most of the rock shelters, for example, in the vicinity of the Chevelon Creek campground are virtually devoid of cultural materials as a result of illicit excavation. The limits of the impact area are essentially defined by the average distance that citizen-users range from the camp during their stay there and this datum is at present unknown. It should be assumed, however, that survey undertaken in conjunction with the development of a new camping area should not be restricted to the direct impacts of construction.

Land exchanges are a potential source of indirect impact since cultural resources on land transferred to private ownership is no longer protected. Unfortunately, the density of cultural resources in the vicinity of rapidly growing communities on the forests is high. Clearly, the relationship between the forests and those communities will deteriorate unless some allowance for their growth is made. Given that growth may occur in virtually any direction, planning for this eventuality should begin soon. Specific proposals are made in the discussion of the inventory of the forests resources.

Conclusion

It is recognized that many of the items discussed in this section reflect existing forest policies. They are mentioned here both as a basis for establishing a baseline for discussing other actions that might be taken to protect cultural resources and because of the relatively few specific changes that are recommend.

PREDICTING CULTURAL RESOURCES

Estimating the quantity of prehistoric sites on the forests is a complex process. This analysis is restricted to prehistoric resources since these are best described by the survey data on which this study is based. Briefly, 439 transects following a spatially stratified pattern have been surveyed on the forests. A total of 177 of these had sites, 416 sites in all. These data will be used to estimate the prehistoric cultural resources in the study area as a whole and for each district within that area. These estimates will then be refined by controlling for extraneous factors that we know to influence the data. The results will then be compared with larger survey blocks that have been done to date as a check on our ability to use transect data in making specific local predictions.

QUANTITY

An Initial Overall Estimate

The 416 sites recovered on 439 transects yield an average number of sites per transect of .95. There are 35.2 potential transects in a square mile yielding an average site density of 33.44 sites. The standard deviation is 1.54. Thus, on the 2000 square miles that are under study one would project a total of 66,880 sites with a minimum of about 57,000 and a maximum of about 77,000 using a 95 percent confidence interval. The mean density of habitation sites is .44 per transect and of limited activity sites, .51 per transect. (Since these figures are not crucial to the current discussion, I intend to provide them in each instance, but will not extrapolate to total numbers of sites.)

Variation in the Estimate Over the Districts

Cultural resources are not distributed evenly over the districts in the study area, therefore, it is appropriate to provide figures for each of them. These are given in Table 2. In Table 3, density estimates for the areas of each district where sites are likely to occur are shown. It should be remembered throughout that only a part of the Alpine and Blue Ridge districts have been surveyed and these figures pertain only to those portions.

An initial evaluation of these results can be made by comparing the values obtained for adjacent districts. Z-scores were calculated for adjacent districts and are shown in Table 4. These scores indicate that it is not possible on the basis of existing information to clearly differentiate each district from the other. Instead, the data are only sufficient for safely concluding that the three easternmost districts have far smaller quantities of prehistoric cultural resources than the westernmost districts, with $p=.05$. The only disturbing aspect of this conclusion is the failure to differentiate the Blue Ridge District with a density of 26.4 sites per square mile from Chevelon with a density of 49.3. In fact, there is only one chance out of ten that the difference between these two districts is not significant.

Improving the Estimate: Areas with Sites

The statistics just discussed represent the grossest approach to calculating the quantity of prehistoric cultural resources that one might take. Refinements can be made in a number of ways. In this section, the data are refined by contrasting the projection of site totals made on the basis of all lands within the study area with a projection based only on the areas that are likely to have archeological sites. The contrast between these two figures is shown in Figure 20. These figures indicate that only about 45% of the study area is actually likely to have sites. Moreover, the percentage varies heavily from district to district; only about 21% of the land on Chevelon district is likely to have sites, while 89% of the land on Pinedale district is likely to have sites. These figures were established by drawing as precise a boundary as possible between those areas on each district characterized by transects, including ones with a few zero site transects, and those areas with only transect lacking sites. In a few instances, transects with sites occur within the zero only zone. These, however, are distinctive and isolated site types and

Table 2. Variation in prehistoric site density across the study area

		MEAN	VARIANCE	STANDARD DEV.	VARIANCE/ MEAN	DENSITY/ SQUARE MILE	ESTIMATED SITES
Coconino Blue Ridge (28 transects)	21 sites 12 habitations 9 artifact sctr	.75 .43 .32	2.12 1.46 .36	1.48 1.23 .61	2.92	26.4	6,943
Apache-Sitgreaves Chevelon (50 transects)	70 sites 25 habitations 45 artifact sctr	1.40 .50 .90	4.52 .77 2.53	2.15 .89 1.60	3.22	49.3	21,437
Heber (81 transects)	139 sites 61 habitations 78 artifact sctr	1.72 .75 .96	3.66 1.17 1.57	1.93 1.09 1.26	2.16	60.5	21,493
Pinedale (86 transects)	115 sites 48 habitations 67 artifact sctr	1.34 .56 .78	2.11 .76 1.01	1.46 .88 1.01	1.59	47.2	15,565
Lakeside (66 transects)	33 sites 21 habitations 12 artifact sctr	.30 .32 .18	1.46 .82 .27	1.22 .91 .52	2.84	17.6	3,696
Springerville (99 transects)	31 sites 19 habitations 12 artifact sctr	.31 .19 .12	.36 .22 .15	.60 .47 .39	1.16	11.0	3,702
Alpine (29 transects)	7 sites 5 habitations 2 artifact sctr	.24 .17 .07	.32 .21 .06	.58 .47 .26	1.38	8.5	1,052

Table 3. Variation in site density, areas with prehistoric sites only

		MEAN	VARIANCE	STANDARD DEV.	VARIANCE/ MEAN	DENSITY/ SQUARE MILE	ESTIMATED SITES
Coconino Blue Ridge (19 transects)	21 sites 12 habitations 9 artifact sctr	1.1 .632 .474	2.877 2.13 .485	1.696 1.46 .697	2.62	28.72	1,936
Apache-Sitgreaves Chevelon (27 transects)	70 sites 25 habitations 45 artifact sctr	2.59 .926 1.67	5.48 1.07 3.54	2.34 1.035 1.88	2.20	91.17	8,205
Heber (57 transects)	139 sites 61 habitations 78 artifact sctr	2.44 1.07 1.37	3.5 1.352 1.70	1.87 1.16 1.30	1.44	85.85	17,599
Pinedale (86 transects)	115 sites 48 habitations 67 artifact sctr	1.34 .56 .78	2.11 .76 1.01	1.46 .88 1.01	1.59	47.2	15,565
Lakeside (45 transects)	33 sites 21 habitations 12 artifact sctr	.733 .467 .267	1.927 1.16 .472	1.388 1.08 .688	2.63	25.8	3,225
Springerville (54 transects)	31 19 habitations 12 artifact sctr	.57 .352 .22	.51 .346 .25	.71 .588 .50	.89	20.21	1,920
Alpine (20 transects)	7 sites 5 habitations 2 artifact sctr	.35 .25 .10	.45 .30 .095	.67 .55 .31	1.29	12.32	616

Table 4. Z-scores for adjacent Ranger Districts

Chevelon-Blue Ridge	1.63
Chevelon-Heber	.86
Heber-Pinedale	1.46
Pinedale-Lakeside	4.00
Lakeside-Springerville	1.19
Springerville-Alpine	.58

Figure 20. Total area of each Ranger District, and total area likely to have sites.

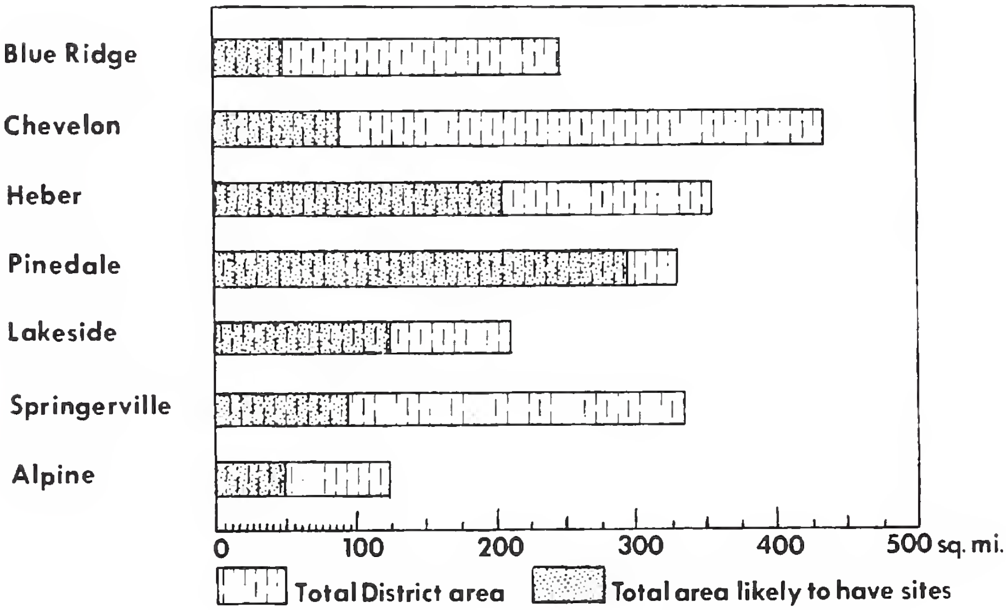


Table 5. Total cultural resource loci, correcting for areas that are likely to have sites

Forest	Sites
Coconino	
Blue Ridge	1,320
Apache-Sitgreaves	
Chevelon	4,435
Heber	12,412
Pinedale	13,915
Lakeside	2,200
Springerville	1,036
Alpine	422
TOTAL Apache-Sitgreaves	34,420
TOTAL Forests	35,740

will be discussed later in using these figures for generating plans for future inventory work. Estimates based on these data are shown in Table 5. Employing a 95% confidence interval there are between 30,000 and 39,000 prehistoric sites within the study area.

Using this revised procedure, the magnitude of the cultural resource management problem faced by the various districts changes dramatically. Because they are districts with both relatively high site densities and relatively large areas that are likely to have sites, Heber and Pinedale districts have cultural resource management needs well beyond those of the other districts on the forests, with Chevelon somewhat distinctive from the remaining districts. It is again important to recognize that figures for Alpine and Blue Ridge districts cover only a portion of those districts.

Correction for Edge Effect

When archeologists first began to employ sample units in archeological surveys, it became apparent that the density of archeological sites was typically overestimated. Intuitively, estimates of site densities seemed to be too high, and when samples could be compared with larger blocks, this intuition was often verified. Interestingly, this discovery was contrary to the assertion made by early opponents of sampling that too few sites would be discovered with sampling. Intitial efforts to account for the overestimation focused on factors such as archeological curiosity and the unevenness of boundaries. When archeologists are in the field, they want to find sites. It is possible, therefore, that slight deviations in the boundaries of sample units arise when archeologists are in the vicinity of what they intuitively recognize as a likely site location. Too many sites, therefore, are discovered by the transects. Similarly, sample units have only imaginary spatial boundaries: the boundaries are not the straight lines that are characteristically drawn on maps. To the extent that surveyors err, they err by surveying a little bit too much.

While these early speculations had reasonable foundation, they are proving to be incorrect. Plog, Plog, and Wait (1978) have identified the real source of the difficulty: a site is found whether or not the entirety of the site lies within the transect. That is, sites lying within one radius of the average site size will typically be found and recorded.

There are two ways to correct for this problem. First, one can carefully distinguish between the portion of the site that actually lies within the transect and the part that does not, using only the former for density projections. Unfortunately, making such a determination is difficult for the reasons discussed above. A second approach is to define the "hypothetical" coverage of the sample unit by anticipating that what has been surveyed is the transect plus a zone on either side of it as wide as the radius of the average site.

Pertinent figures are shown in Table 6. The mean size of sites for each of the forests' districts is given as well as the radius of a site of that size. These figures are incorporated into density estimates in Table 7. Prior to correction, each transect was assumed to represent 1/35.2 of a square mile (1760 ÷ 50=35.2). For each district a new multiplier is obtained by adding to fifty, twice the value of the radius. As is obvious, the application results in a far lower estimate of site densities and total sites.

Correcting for Variation in Transect Size

Another error in the density estimates occurs because the transects surveyed in the various summers were not of identical sizes. As noted earlier, transects of 50 meters by 20 kilometers, 100 meters by 1 kilometer, 50 yards by 1 mile, and 50 yards by 1.4 miles were used. Table 8 shows the number of transects actually listed in comparison with "transect equivalents." Given this correction, slightly more transect equivalents were surveyed on the Chevelon, Pinedale, and Lakeside districts. New density and total site estimates are generated using this, in addition to the preceding corrections. The total number of sites on the forests is most likely to be about 18,000 with 95% confidence that the total is between 13,500 and 22,400 sites.

Area

It is also useful to consider the meaning of these figures in relation to the area of the forests that is covered by cultural

Table 6. Statistical basis for the edge effect correction

	Mean Site Size	Correction Factor	Revised Transect/ Square Miles
Blue Ridge	2625 square yards	28.9 yards	16.3
Chevelon	1397	21.1	19.1
Heber	1966	25.0	17.6
Pinedale	997	17.8	20.6
Lakeside	547	13.2	23.0
Springerville	1291	20.3	19.4
Alpine	1188	19.5	19.8

Table 7. Corrections for variable transect size

	Transects	Transect Equivalent	Site Density/ Square Mile	Estimated Number of Sites
Blue Ridge	28	28	12.3	613
Chevelon	50	56	23.9	2,151
Heber	81	81	30.3	6,212
Pinedale	86	101	23.5	6,932
Lakeside	66	76	10.0	1,250
Springerville	99	99	6.0	570
Alpine	29	29	4.8	240

Table 8. Density and estimated sites after correcting for edge effect

	Total Transects		Transects in areas with Sites	
	Density/ Square Mile	Estimated Number of Sites	Density/ Square Mile	Estimated Number of Sites
Blue Ridge	12.25	613	18.0	900
Chevelon	26.7	2,403	49.4	4,446
Heber	30.3	6,212	42.9	8,795
Pinedale	27.6	8,142	27.6	8,142
Lakeside	11.5	1,438	16.8	2,100
Springerville	6.0	570	11.1	1,055
Alpine	4.8	240	6.9	345
TOTAL		19,618		25,783

Table 9. Square yards area of cultural resources in the study area

	Minimum Area	Percent	Maximum Area	Percent
Blue Ridge	1,614,375	1	5,082,000	3
Chevelon	3,004,947	1	11,462,804	4
Heber	12,211,809	2	34,600,125	6
Pinedale	6,911,703	1	13,882,228	2
Lakeside	683,750	.1	1,764,075	.5
Springerville	735,870	.3	2,478,655	.8
Alpine	285,120	.2	731,808	.5

resources. Table 9 gives a minimum, based on the final density estimates, and a maximum, based on the uncorrected density of Table 3. The potential percentage of the land surface on each district that is occupied by cultural resources is indicated. In Table 10, these figures are converted to acres. For the forests as a whole, using the highest foreseeable density estimate up to the 95% confidence limit, it is unlikely that the average acreage per square mile occupied by cultural resources is greater than 42. Clearly, it should be possible in all but the most destructive of land modification activities to find means of preserving those sites. Even in the case of sections with extremely high densities, there is no reason to believe that anything exceeding half of the section's surface area would be covered by prehistoric sites and figures as high as 33% will be the exception, not the rule.

Discussion

Given all of the corrections, what is the reality of the figures? Ultimately, only the test of time will resolve that question. The estimates are the best that can be generated using available data. One quick evaluation can be done however, by comparing these estimates with more extensive survey efforts, where possible. The projected density of 26.7 for the Chevelon district compares with a density of 23.2 sites per square mile for the 2.3 square mile Chevelon Juniper push area as it has now been expanded (Lerner 1979). The 4.4 square mile Purcell Larson survey area has a mean density of 31.5 sites compared with a projected density of 30.3 based on the sample. Densities in the left Hand Draw and Nick's Camp timber sale, in those areas which have sites, vary between 22 and 27 sites per square mile. The transect projection is 23.5 sites per square mile. These are all surveys done because of management needs. The areas were not selected because of any cultural characteristic, and the correspondence to mean figures generated from the transect sample is striking.

On Blue Ridge, Chevelon, Heber, Pinedale, and Springerville districts there are also larger survey units placed in areas specifically because of the high density of sites anticipated there. The densities for these survey units are 58.7 on Blue Ridge, 38.4 on Chevelon, 53.8 on Heber, 32.4 on

Table 10. Acreage of resources in the study area

	Minimum Acres/section	Maximum Acres/section
Blue Ridge	6.7	21.0
Chevelon	6.9	26.3
Heber	12.3	34.9
Pinedale	4.8	9.7
Lakeside	1.1	2.9
Springerville	1.6	5.4
Alpine	1.2	3.0

Pinedale, and 20.0 on Springerville. These figures should provide good upper limits for likely site densities on those districts.

DISTRIBUTION

While the quantity of cultural resources within a particular spatial area is critical to wise management decisions, those resources can be distributed in drastically different ways even with the number of resources held constant. If, for example, two districts have site densities of 20 sites per square mile, but on one district those sites are clustered in a few very high density locations while on the other districts they are evenly dispersed over the entire area, the planning problems faced by the two districts differ almost totally. In the case of the first district, it is easier to plan around the resources; when there are alternative project locations that are equally viable from the perspective of the project parameters, it is possible that one or more of the alternatives may be in low resource density loci. On the other hand, when project locations on this district cannot be modified, a particular project is likely to have either substantial or no impacts on cultural resources. In comparison, a district with an even dispersion of sites is likely to find that virtually any project will have a potential impact on some resources. The purpose of this section is to evaluate this problem as it pertains to the various districts.

Symap

The use of SYMAP in describing site distributions in the area has been described in detail in a previous report concerning one of the former planning units on the forest (Hantman 1978b). Figure 21 is a SYMAP generated using the 439 transects as a data base. A number of generalizations can be made on the basis of this map. First, the heaviest densities of sites occur on the western districts of the forests. Second, with the exception of Pinedale and Lakeside districts, the heaviest densities are generally toward the northern edge of the forests. Third, there is apparent variation in the patterning of the site distributions on the various districts. Blue Ridge district has a very small high density area, and a relatively erratic pattern of density variation. On Chevelon and Heber distiсts, there are areas of high site density surrounded by zones of decreasing density in a reasonably smooth pattern. Pinedale district is sirilar to these two, but the zones of higher density are somewhat more constricted and tortuous. On Lakeside district there is only a single high density area and several quite distinct lower density clusters. A generally clustered pattern is also typical of Alpine and Springerville districts with relatively moderate densities in even the most densely occupied areas.

Statistical Approximations

SYMAP provides a visual display of variation in site density, but its interpretation is imprecise. Boundaries on the map are usable only as suggestive for planning purposes, not definitive. That is, the technique is useful in identifying the existence of prehistoric cultural resources, at an early stage of the planning process, but not the absolute magnitude of those resources.

Statistical approximations allow somewhat more definitive statements. A number of pertinent statistics are shown in Table 11. The first of these, the coefficient of variation, is simply the standard deviation of the distribution divided by the mean. It provides an index of the extent of variation around the mean. In general, variation is lowest on Heber and Pinedale districts and greatest on Lakeside and Alpine, with the other districts intermediate. The second figure shown is Morrill's (1970) index of contiguity. This figure represents the average difference in value between a set of spatially contiguous entities. In this case, those areas of each district with sites were divided into 3 miles by 3 miles blocks and their average sites per transect compared. The figure indicates that the Springerville district is characterized by great discontiguity, i.e., the cell values of adjacent 3 miles by 3 miles blocks vary greatly. Discontiguity is very low on Heber district--little variation occurs from one 3 mile cell to adjacent ones.

Five different patterns emerge when these data are treated together.

Pattern 1 - Springerville and Alpine districts: Overall, site density is low,

Figure 21. SYMAP of site densities across the forests.

Table 11. Coefficient of variability and index of contiguity

	Coefficient of Variability	Index of Contiguity
Blue Ridge	1.97	1.02
Chevelon	1.54	.605
Heber	1.12	.087
Pinedale	1.09	.811
Lakeside	2.43	1.059
Springerville	2.00	
		1.89
Alpine	2.39	
Forest	1.65	

but there is great variation from area to area in where sites are. Sites generally occur in clusters that are surrounded by areas without sites. The majority of projects will probably have limited potential impacts on cultural resources, and those that do have potential impacts will not encounter the high level of problem that exists elsewhere on the forests.

Pattern 2 - Lakeside and Blue Ridge districts: Overall densities are moderate, but there is substantial variation from one location to another over the districts. Areas of high site density are randomly dispersed, there are both zones and isolates of high density areas.

Pattern 3 - Heber district: On this district densities are high, and spatial variation relatively low. In areas with sites, most projects of any substantial size will encounter some resources.

Pattern 4 - Pinedale district: On this district density is high and variation from one locus to another relatively low. The patern of variation in density is more random, less evenly zoned than on Heber district, and therefore somewhat less predictable.

Pattern 5 - Chevelon district: Site density is high and spatial variation great. Nevertheless, there is a fairly even zonation to the pattern of density change. Most projects will encounter cultural resources; while there will be great density variation, a slight adjustment in project boundaries is unlikely to change the situation.

Each of these patterns has different implications for alleviating the impact of a project by slight adjustments in its location. On Springerville and Alpine districts, few projects (relatively) will encounter cultural resources. When these are encountered they will be present in moderate numbers, but a slight shift in project boundaries, when this is feasible, may completely alleviate the problem.

On Lakeside and Blue Ridge districts, projects will more likely encounter sites, although not in very great numbers nor in a very predictable fashion. The random spatial variation in density means that the advantages of slight shifts in project boundaries will be unpredictable, although advantages will be realized some percentage of the time.

On Chevelon, Heber, and Pinedale districts, the probability of encountering resources is quite high. Projects on Chevelon district will somewhat less typically encounter high site densities. On Heber district a slight shift in project boundaries will rarely result in much advantage given the even pattern of variation in densities. On Pinedale and Chevelon districts, the relatively random variation in density means that the advantage of slight shifts in project boundaries will be unpredictable, but may sometimes be realized.

The preceding discussion concerns the overall pattern of the districts. A final statistical datum that is of use in evaluating the situation is variation in site spacing within localized areas. Unfortunately, since most of the currently available data from the forests are transect data, local variation can be assessed for only a few locations. The statistic used for this purpose is the nearest neighbor statistic which achieves a value of 0 when a distribution is clustered, 1 when it is random, and 2.15 when it is evenly dispersed. There are four loci to which this measure can be applied, the Chevelon Juniper Push (Legard 1978), Pinedale (Most 1978), Purcell-Larson (F. Plog 1975), and Bagnal Hollow (Grove 1978). The values for these survey units are: Chevelon =1.15, Purcell-Larson =.5, Pinedale =.66, and Bagnal Hollow =ca. 1.0. While the significance of all but the two most extreme values cannot be demonstrated, variation among the districts is again indicated. The local site distribution in Chevelon district is random, while that on Heber (Purcell-Larson) is clustered. The values for Pinedale and Bagnal, both on Pinedale district, do not differ significantly. Therefore, a clustered to random distribution is indicated. In general, these data suggest that local variation on the districts closely parallel variation as measured by the district level statistics discussed earlier. If subsequent survey results bear out this conclusion, and survey research that could underwrite such an effort will be discussed later, then the following conclusions would be justified for the various districts.

Within localities on Heber, Alpine, and Springerville districts where cultural resources are encountered, these will tend to be clustered. There will, therefore, be substantial quantities of open space that can be used in an effort to avoid the resources. When projects on Lakeside, Blue Ridge, Pinedale, and Chevelon districts encounter cultural resources, those resources will be randomly distributed. While it may be possible to design an approach that avoids impacts, such an effort will be complicated by the unpredictability in the location of nearby sites.

PREDICTING SITE LOCATIONS

The development of models for predicting site locations on the basis of environmental characteristics is essential to wise management of cultural resources. If the likely presence of resources can be assessed on the basis of environmental maps, a quick field check, or both, the intergration of cultural resources protection measures with other aspects of multiple use planning is facilitated. A number of such predictors are identified in this section.

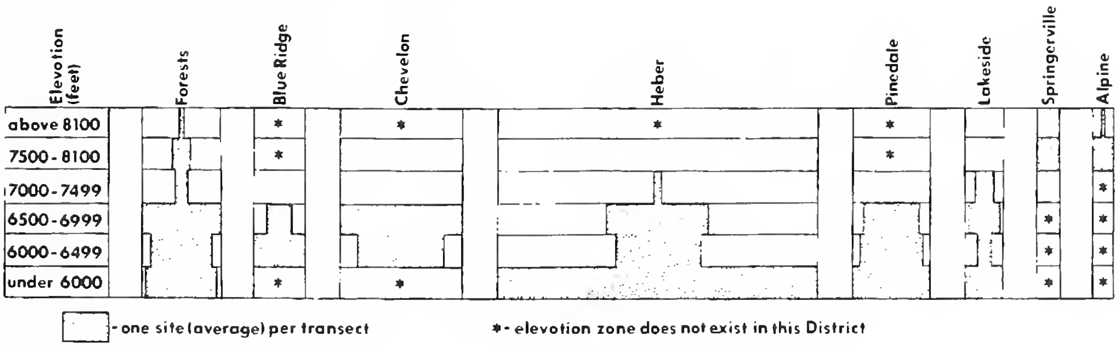
Elevation

Across the study area, elevation is highly correlated with two variables that would have been critical to prehistoric peoples, vegetation and rainfall. Rainfall figures are not currently described in sufficient detail over the forests to allow the use of this variable in prediction. Vegetation has been identified as an important predictor in previous studies on the forests (Plog 1978, Wood 1978, Lerner 1979). In general, high site densities are found in the juniper-pinyon woodland and in its ecotonal associations with other communities. Yet, it would be inappropriate to specify the woodland boundary as an exclusive marker of cultural resource boundaires since that boundary has changed through time as a result of both natural and cultural processes. For this reason, elevation is used as a surrogate variable, although the discussion will later return to a specific consideration of vegetation.

Mean site densities in relation to elevation for the forests and for each district appear in Figure 22. For the study area as a whole, 99% of all cultural resources occur at elevations of less than 8000 feet, 92% at elevations below 7500 feet, and 88% at elevations below 7000 feet. Ninety-five percent of the cultural resources occur at elevations above 6000 feet. The mean density of sites in this zone is not statistically different from that of the 6000-6499 foot zone at the .05 level and the distinction between the two zones is not useful for predictive purposes. The 6000-6499 and the 6500-6999 zones also cannot be separated statistically. These three lowest zones are significantly different at the .05 level from all of the zones above them. The 7000-7500 and the 7500-8100 foot zones do not differ from one another at the .05 level, but both differ from the 8101 and above zone.

These figures can be refined somewhat for each district. On Blue Ridge District 100 percent of the resources occur at elevations between 6000 and 6999 feet. The difference between the two zones is not

Figure 22. Average number of sites found in transects in Ranger Districts, sorted by elevation zones.



statistically significant. The same pattern occurs on Chevelon District. On Heber District, 99% of the sites occur between 6000 and 6999 feet. On Pinedale District 95% of the sites occur in the same zone, although a few occur at lower elevations at densities that cannot be separated from the higher zone. On Springerville District, 100% of the sites occur at elevations between 7000 and 8100 feet. Thus, while the elevational boundaries are different from other districts elevation nevertheless serves as a good predictor. On Alpine District, altitudes above 7500 and below 8100 feet are those at which 86% of the resources occur.

The only district on which elevation does not prove to be a good predictor is Lakeside. Cultural resources are equally likely to occur in all the zones up to 7500 feet. The problem on this district probably reflects two factors. First, the land surface is substantially formed by relatively recent vulcanism which created isolated pockets of useful and useless land. Second, while this pattern is characteristic on the eastern part of the district, the western part more or less reflects the Pinedale pattern.

Vegetation

Given the preceding discussion, the question that must be addressed in the case of vegetation is whether one can improve prediction by using vegetation as a variable in addition to elevation. The answer is that prediction is not improved by the addition of this variable. Neither ponderosa pine-alligator juniper nor more open pinyon-juniper woodland situations can be distinguished from the pinyon juniper woodland itself. Only in the case of Chevelon District is there a significant difference, that between pinyon-juniper and ponderosa pine-alligator juniper with no sites occuring in the latter community. Our previous arguements that vegetation could serve as an accurate predictor are in part correct and in part incorrect. Using the transect data, it is not possible to identify effects of vegetation separable from those of elevation. However, more detailed local studies such as those done in the Pinedale area (Jewett 1978, Lightfoot and DeAtley 1977), do show differences. The differences that exist are, however, at a level that is useful for studies of prehistoric land use patterns. From the perspective of cultural resource management, the densities are so close to one another that planning activities should envision identical treatments of the areas.

One final aspect of vegetation warrants mention. In the case of field inspections of project locations, three plant species can be important to identifying the presence of sites because they tend to grow in disturbed soil situations: agave parryi, wolf berry, and saltbush. Agave parryi and saltbush often grow on archeological sites from Lakeside District west. Wolf berry, while it occurs on sites on all of the districts is best as an indicator on Alpine and Springerville Districts.

Soil

There is at prèsent no single comprehensive soil map for the study area rendering an overall approach to this variable problematical. This initial difficulty is compounded by the fact that transects typically pass through more than one soil zone. Nevertheless, previous studies have shown this variable to be an important one in predicting the occurence of cultural resources.

There are three areas where detailed soil analyses are possible: the area of the Mogollon Planning Unit lying on Chevelon District, the White Mountain Planning Unit, and the eastern sector of the Little Colorado Planning Unit. Soil zonation on the Chevelon District is complex; discrete zones are typically sinuous and intertwined. For that reason, the relationship between soil and the cultural resource distribution was evaluated not on the basis of the soil zone in which a particular transect occurs (most transects cross-cut at least two zones) but on the basis of the predominant soil type within one mile of the transect. Twenty-four transects were analyzed in this fashion. The major contrast indentified was between Purner and Dye soils and Tortugas soils. Transects in areas where the former soils are characteristic have a mean site density of .67. Sites on Tortugas soils average 2.72. The difference is significant at the .05 level. Interestingly, transects on Purner-Dye, a soil type that is a composite of that on which low densities were found, has an average density closer to that of the Tortugas group, although the density is highly variable.

A far more detailed study would be desirable before reaching a final conclusion concerning the relationship between prehistoric cultural resource densities and soils on this district. However, the analysis suggests that densities will be nearly four times as high in sections where the Tortugas and Purner-Dye soils predominate than in sections where either Purner or Dye is common. In planning cultural resource management strategies, the percentage of the different soil types in the project area can be used as a means of modifying the estimate based on mean densities for the district alone. While soil maps are not available for relevant portions of Heber District, its soils are generally similar to those of Chevelon, and the same approach can probably be applied there.

The situation on the White Mountain Planning Unit is somewhat more straightforward. While the pattern is certainly not simple, there are broad areas with identical or closely related soils. Soils associated with the presence of sites are Schoens gravelly sandy loam, Bluegrass gravelly, sandy loam, Bluegrass-Roundy-Whipple Association, Dickers-Jacks Association and Comples, McVickers sandy loam, Woolhouse gravelly loam, Polson gravelly sand loam, the Wishbone-Ecks complex, and the Tenny-Flume Complex. The mean number of sites per transect from these soils is 1.73. Soils associated with the absence of sites are the Mystery Rock Outcrop Complex, the Bluestem-Penrod Complex, Springerville Clay, the Bluestem-Springerville Complex, and the Thunderbird Penrod Complex. The mean number of sites per transect associated with these soils is .17. The difference between the two densities is significant at the .01 level. This same pattern of variation is extensible to the eastern edge of Pinedale district and the remainder of Lakeside district. Ninety-five percent of the sites on the Planning Unit occur in conjunction with these soils, while only about 65% should occur there given their spatial extent. Clearly, there is substantial variation in site density even within the high density group. But, the association remains strong enough that this predictor provides a meaningful management tool.

The relationship between soils and sites per transect on the Little Colorado Planning Unit has been described by Wood (1978). The soils with which sites are associated are: Nutrioso Loam, Herschede Gravelly Loam, Indian Tank Loam, and Saffel Loam. However, even when these soils are present variation in the specific density of sites is too high to allow refined statistical treatment. If the soils in question are absent, it is unlikely that sites will be found. If the soils in question are present, the presence of sites must be assumed, but sites will not always be found there.

Proximity to Private Land

Previous studies have indicated that proximity to private land is a good indicator of high cultural resource densities. On the White Mountain Planning Unit, 1.4 times as many sites were found on transects in proximity to private land as on transects distant from it (Donaldson 1975). On the Little Colorado Planning Unit, 2.5 times as many sites per transect are recorded in proximity to private land. This pattern can be generalized for the forests as a whole, when private land lies within the elevational zones where sites are likely to be found. Variation in the magnitude of increased site density is too great to permit precise quantification of this effect, but it can and should be taken into account as a general guide in assessing the likelihood that a particular project will encounter site densities above or below the average for any particular district.

Landform and Hydrology

These two variables were also considered as potential predictors. In a general sense, landform is one. Everywhere on the forests, sites are more likely to occur on elevated landforms--knolls, ridges, hills etc.--than on floodplains. Water control features are the only major exception. However, the specific landform with which sites are associated varies from one area to another.

Hydrology as measured, for example, by Strahler's drainage rank statistic, would also seem a useful predictor. However, give the proximity of all of the drainages on the forests to their headwaters, calculations of drainage rank proved insufficiently varied to allow use of the measure.

NATURE OF THE ARCHEOLOGICAL RECORD

To this point, I have assumed the integrity of the data base that underlies the assessments that have been made. Such an assumption is the only practical way of proceeding: one never knows what data one has failed to identify or find. It must ultimately be called into question in order to identify outstanding problems, the resolution of which will ultimately improve control over, and planning for, protection of the resources. The discussion in this section focuses on such an evaluation. As specific problems are raised, two questions are addressed: (1) How may such problems affect the conclusions reached in this report? (2) What research strategies may refine our understanding of the importance of the problem in knowing the forests' cultural resources?

The theories of importance to this particular problem fall under the general heading of transformation processes. Schiffer has described in detail the processes that form, transform, and reform the archeological record at particular sites in a series of articles (Schiffer 1975a, b, 1976, 1978; Schiffer and Rathje 1973; Reid, Schiffer, and Neff 1975). There is no point in repeating the details of his discussions here. A major issue arises from the fact that the focus of the articles in question is on sites and excavation. Little attention has been given to regional phenomena and to data collected largely through survey.

This situation raises obvious questions. Are there transformation processes that effect the regional record in ways other than their manifestation at specific sites? Does the fact that the regional record is known largely through surface collection generate problems in the understanding of transformation processes that shape the record? The answers to these questions are best derived through a focus on transformation processes.

NATURAL TRANSFORMATION PROCESSES

Environmental Change

When site records are generated by survey, archeologists commonly make observations of the natural context in which the sites are found. Yet, because environmental change occurs, it is impossible to assume that the archeological context in which sites are presently found and the systemic context in which they originally existed are identical. At the same time, it is unreasonable to assume either that the archeological and systemic contexts differ or that the degree of difference is the same for all environmental variables.

While the archeological and systemic contexts of sites may be different, they are not necessarily so. In the early days of Southwestern pollen studies, many archeologists assumed that sharp contrasts between modern and at least some prehistoric conditions would be revealed. What is remarkable about the last decade's results is the limited evidence of change that has been documented. Certainly the environments of PaleoIndian and Archaic sites differed drastically from those of the present. But, for later prehistoric sites, the evidence for drastic differences is unclear. That change occurred is clear; that the resulting environmental variation lay beyond the limits of modern variation is not.

Similarly, it would be a mistake to assume that the magnitude of change was the same for all relevant environmental variables. Precipitation and temperature conditions are the most likely to have changed. Vegetation patterns may or may not have changed. The character of drainages in an area is likely to have been similar at some points in the past and different at others. Major topographic features, in the absence of recent vulcanism, are less likely to have changed, although some topographic features, e.g. dunes, are more likely to have changed than others, e.g. basalt capped mesas. Certainly, a careful consideration of the probable magnitude of similarities and differences between modern environments and those that formed the systemic context of site systems at various points in the past is warranted. But, the analysis should never, simply, presume differences of great magnitude.

Deposition

Deposition is likely to have a major impact on our understanding of the regional record in most areas. The existence of deposition is not the major source of the problem; even when it is heavy, sites can be located if appropriate survey techniques are employed. The problem is the differential effect of deposition, spatially, temporally, and functionally. Temporally, the problem is straightforward: all other things equal, older sites are more likely to be buried than younger ones. Spatially, some topographic environments are characterized by higher rates of deposition than others. Deposition is more likely to have obscured elements of the archeological record in broad alluvial valleys than on flat mesa tops. Finally, there are functional problems: small and ephemeral loci and those reflecting activities associated with depositionally active locations are more likely to be obscured by deposition than larger and more permanent loci. Because prehistoric peoples carried out different activities in loci with different depositional conditions, it is necessary to consider the possibility that prehistoric activities associated with particular resource zones or time periods have been diffe entially obscured by deposition.

Erosion

The situation with erosion directly parallels that of deposition. Because they have been exposed to erosional agents for longer periods of time, older sites are more likely to have been removed and redeposited than younger ones. Smaller sites, those that were originally characterized by few materials, are more likely to have been erased than larger ones. Sites in topographic environments that are active erosionally are more likely to have been removed than those in zones of less activity.

Differential Erosion/Deposition

The interaction of erosion and deposition create a still more complex set of possibilities. One can imagine environments where one but not the other, both, or neither were active during the relevant time interval. The greater the complexity of the interaction between the two processes within a study area, the greater the probability that some elements of the archeological record have been preserved differentially.

Catastrophes

While catastrophes should not be used to explain the evolution of prehistoric groups, the potential effects on the record of, for example, major floods or volcanic eruptions cannot be ignored. These are clearly capable of obliterating evidence of prehistoric occupation over large areas.

Discussion

What is the likely effect of these processes on our ability to see and to interpret the forests' resources? Environmental change is a first issue. At present, environmental change in the vicinity of the forests is not understood in great detail. However, dendroclimatological studies do clearly indicate that significant variation in rainfall has occurred in the past and that this was probably correlated with changes in the distribution of major plant communities (Dean et al. 1978). How great the change that occurred has been is difficult to say. In all probability there were, at various points in the past, significant differences in the location of the major vegetative communities on the forests. While this change should not have significant effects on our ability to locate sites, it should have a significant effect on interpretation. If the plant communities in which sites are found today are different from those of the past, it is not possible to make inferences concerning subsistence behavior or extractive patterns from simple locational data. On the other hand, this problem does not affect our ability to generate predictive models since these depend only on knowing the locations of sites in relation to present vegetation. The long term usefulness of those predictive models will, of course, depend only on knowing the locations of sites in relation to present vegetation. The long term usefulness of those predictive models will, of course, depend on future environmental variation.

Deposition, erosion, and their interaction present a definite problem in site identification. The problem can be described in a number of ways. First, potholes on sites in the Pinedale area are the only source of evidence that some sites have structures on them. The structures in question are substantial pueblo masonry structures, yet the only surface manifestation is an artifact scatter. In areas of the forests where sites are so deeply buried, the percentage of limited activity sites is probably overestimated and site densities are probably artificially low; if masonry structures appear as artifact scatters, there are probably artifact scatters that are not visible at all.

Second, not all areas of the forest are equally active in respect to deposition and erosion. In general, as one moves from west to east within the study area, soil depth increases from characteristic depths measured in centimeters to depths measured in meters. The width of valleys also generally increases from average measurements in the tens of meters in the west to averages in the hundreds in the east. Maximum values are measured in hundreds of meters to the west and in kilometers to the east. Thus, moving from west to east the probability of site burial increases and the spatial extent of the surface that may overlie buried sites increases.

From an interpretive perspective, this variation simply means that archeologists must be very careful in assuming the equivalency of the archeological records at the eastern and western extremes of the forests. From the perspective of managing cultural resources, it means that projects that will result in deep ground disturbance are more likely to encounter buried sites to the east and that monitoring of construction in such circumstances is advisable.

A final issue that involves both vegetation and geomorphology concerns the likelihood that sites in some vegetative communities are more likely to be obscured than in others. This problem seems especially great since sites occur in limited numbers in the ponderosa pine type over most of the study area and since anyone who is aware of the ground conditions where that type predominates knows that a heavy cover of duff is typical. Throughout the surveys described herein, it has been our impression that duff was not a major problem. While it did exist, it did not form a continuous cover over the ground surface that was typically widespread enough to obscure entire sites.

Nevertheless, additional transects were surveyed in ponderosa areas. These did not alter our earlier conclusions concerning the dearth of cultural resources. We have now also been able to survey two recently burned areas. One is in an area where the transect data would have projected a site density of zero and another where moderate density would have been predicted. One of these was in pure ponderosa, the other in ponderosa pine-alligator juniper, but with a dense duff cover. The predictions of the transect information were upheld in both instances. While this discovery does not resolve the potential impact of duff on the interpretability and visibility of the record in different areas, it is another bit of evidence that the problem is not an extreme one.

CULTURAL TRANSFORMATION PROCESSES

Systemic-Archeological

Schiffer uses the concept of Systemic-Archeological (S-A) process to refer to those processes by which artifacts and sites move from a systemic to an archeological context: primary and secondary discard, abandonment, loss and burial. (Schiffer uses the term "disposal of the dead." I prefer the term 'burial' since objects other than human bodies and including whole sites can be purposefully buried, and since the dead can be disposed of by what amounts to discard.) These same processes operate to form the regional archeological record. However, a major problem exists in regard to differences in their relative effects at different loci.

When the prehistory of a region is approached through surface collection and the generation of site records, it is extremely difficult even to identify the specific processes that led to the artifacts' presence on the site surface. While S-A processes can be difficult to identify or control for when sites are excavated, there are at least some contextual bases for attempting their identification. But, materials removed from the site surface often lack such context. It is sometimes, but not always, possible to differentiate a deep midden from a thin surface scatter. While artifacts collected from within the boundaries of a room were not necessarily used in that room, they may have been used there. While a thin scatter of artifacts on a depositionally and erosionally stable surface may represent sheet trash, it may also approximate the distribution of materials left by the inhabitants of a camp site closely enough to allow behavioral inferences (see Wait 1976). If collections made from some sites are largely from areas of primary refuse and closely reflect a discrete set of activities carried out there, but collections made at another site are largely from areas where secondary refuse reflecting no particular set of activities is common, the potential is very high for making incorrect inferences concerning the activities carried out at the two sites.

Such problems become even more extreme when both relatively discrete high density artifact scatters and amorphous low density scatters exist within a single study area. In the first instance, the relation of the latter to the former is extremely problematical since the latter could represent the movement of artifacts from high density sites by natural or cultural processes or could represent a discrete activity pattern. On the basis of surface evidence, resolution of this issue is close to impossible.

When low density scatters are the only observable cultural loci the nature of the S-A processes that formed the site are even more difficult to infer since the context of the materials is even less clear. While a greater than expected occurrence of artifacts in some specific plant community, for example, could be produced by primary discard and indicate extensive use of that community, it could also reflect the centrality of the community alone--more people walked through it more times during a particular annual round and lost or discarded more artifacts. This problem has not been adequately addressed by proponents of "non-site" archeology.

A final problem involving S-A processes is burial. Simply put, aspects of the archeological record generated by purposeful burial are extremely unlikely to be known on the basis of surface survey or surface collection.

Archeological-Systemic

Archeological-Systemic (A-S) processes are those that move artifacts from the archeological context to that of the modern system: collecting, pothunting and excavation. Collecting and excavation are of little concern since they are generally documented, although unpublished survey and excavation do create problems. Pothunting and collecting can have a major, capricious, elusive effect on the regional record. Sites to which the public has easy access are more likely to have been effected by such activities than sites to which access is difficult. Large and obvious sites are more likely to have been impacted than smaller and more obscure ones. Finally, the kinds of artifacts that are removed from site surfaces may be quite specific. Metates and other large objects are more likely to have been removed from high than from low access sites. Decorated pottery and formally made tools such as projectile points are more likely to have been removed than undecorated pottery and debitage or casual tools. Thus, the kinds and frequencies of artifacts found at sites can be greatly affected by the differential removal of materials from them.

Archeological-Archeological

Archeological-Archeological (A-A) processes are those that move cultural materials within the archeological context: Later occupation, land-levelling and channelization. Two major problems in interpreting the prehistoric record arise from the consideration of these processes. The first is later occupation. When sites are known principally through surface collections, (a) earlier components may be variably obscured by later deposits, and (b) differentiating sites with lengthly occupations spans from sites with a large number of episodic occupations may be impossible.

The first problem is illustrated in recent work by Arizona State University at Chavez Pass Ruin. A number of previous investigators (e.g., Wilson 1969) argued for the sequential occupation of the three major room blocks at this site. Our own surface collections supported these earlier conclusions. Once test excavations were undertaken, however, a quite different pattern was apparent. The occupations of the three room blocks were late and largely contemporaneous. The three areas differed in the extent of earlier occupation and/or the extent to which earlier deposits were buried by later ones.

The second problem is equally evident if characterized in the context of seriation analysis. The relative percentages of materials from different time periods are likely to be the same whether a site was occupied throughout each of a series of time periods or only for short episodes during each. There is the further problem of early and late episodic occupations being obscured by lengthly occupation during some intervening period.

Land-levelling and channelization have regional impacts since these activities are non-randomly distributed in relation to environmental variables that may have been important to prehistoric peoples. Juniper pushing, for example, can easily obliterate much of the archeological record in a woodland while leaving intact that in nearby grasslands and pine parklands. Similarly, channelization is most likely to have occurred and destroyed sites in the vicinity of major drainages. Thus, select elements of the regional record can be removed while others are left intact.

Systemic-Systemic

Systemic-Systemic (S-S) processes are ones that move cultural materials within a systemic context: recycling, secondary use, lateral recycling, and conservation. The negative effect of such processes on the prehistoric record is potentially great and difficult to evaluate. In essence, the question raised is the extent to which the first pothunters were in fact later prehistoric occupants of particular regions. This problem is perhaps most evident in the case of projectile points. In some areas, early and late manufacture technologies have been identified (cf. F. Plog 1974). Yet, most late sites, even the very latest ones typically have points made using the early technology. Whether this pattern reflects the survival of the earlier technology, or the systematic removal and reuse of earlier points from earlier sites, is impossible to say. The removal of building stones from earlier sites for use in the construction of later ones has also been discussed. While such behavior almost certainly occurred, it is easy to confuse a settlement that had only foundation stones rather than full standing walls with one from which the stone that formed full standing walls was removed. The ultimate extent of recycling and reuse at the regional level will be difficult to define. But, it certainly must be controlled for rather than simply assuming that the materials found in a particular loci were made by the people who lived there or by their contemporaries.

Clearly, one can become so concerned with the potential role of such processes that paralysis of multiple dimensions results. I will not argue, as some proponents of the study of transformation processes seem to, that one cannot do archeology without controlling for such processes. At the same time, one should never fail to control for intervening variables of whatever sort when it is easy to do so. To the extent that understanding the impact of transformation processes at the regional level requires research specifically attuned to understanding those processes, it is the obligation of the transformation process school to undertake pertinent studies. To the extent that simple tests that identify the effects of such processes on the regional record can be undertaken, we are all obliged to do so.

There are specific aspects of cultural transformation processes that warrant discussion. Our understanding of the manner in which the archeological record was formed on the forest is at present quite limited. Nor are there currently good data sets that could be used in addressing this particular problem. Surface-subsurface relations and the distinction between occupation span and stability of occupation are examples of problems critical to interpreting the archeological record that cannot be addressed at present. Therefore, future research on the forests should include elements of research design that address such issues.

Low density artifact scatters represent a major management problem. To the extent that these can be shown to be products of purposeful human behavior, they are important and their management is warranted. If they are the product of casual or accidental behavior less concern is warranted. Since such manifestations often occupy large areas and do occur in locations where timber harvests and other land modification activities are planned, a rapid resolution of this question is essential to the design of wise management strategies.

Transformation processes are continuing to impact the archeological record on the forests. Table 12 described these processes in two categories, vandalism and other disturbances, which includes logging, chaining, road construction, etc. For the study area as a whole, impacts of some variety were found at 24% of the sites. While this figure should not be construed to mean that 24% of the forests resources have been totally destroyed, it does mean that their integrity has been in some way effected.

There is also considerable variation from district to district. Vandalism is somewhat less of a problem on Blue Ridge, Chevelon, and Lakeside districts, although most of the larger and more obvious sites on these districts have been heavily impacted. Heber, Pinedale, Alpine, and especially Springerville Districts are more heavily impacted. The evidence from these districts suggests that even smaller and less obvious resources have been impacted. In regard to disturbances from land modifying activities, Blue Ridge district is a particular problem since a very high percentage of the land within the study area has been cleared of juniper. Pinedale and Springerville districts also evidence impacts well above the average for the study area.

Continued disturbance from land modification is unlikely as a result of the cultural resource management policies adopted by the forests. Vandalism continues to be a problem because of the difficulty of monitoring the activity and of prosecuting those involved. Two simple studies were done in an effort to refine understanding of where this impact is most likely to occur. The first evaluated the proposition that the problem is greatest near population centers and the second the proposition that it is greatest in high access areas away from population centers. In each case a sample of appropriate transects was selected and the site records inspected again to determine if there was evidence of impacts.

Of the twenty sites that fell in the sample chosen to investigate the first proposition, six (30%) had been impacted, five (25%) by vandals. Thus, in proximity to population centers, the incidence of vandalism is 150 percent of that for the study area as a whole and the incidence of land modification impacts is 25% greater. The sample size used here is small and cannot be enlarged without severely testing the notion of proximity to a population center. Therefore, this evidence should be taken as indicative but not conclusive. On balance, sites close to population centers warrant closer monitoring either by the Forest Service or concerned local citizens, an issue to be addressed later.

Of the twenty sites in the sample used for evaluating the second proposition, 10% had been vandalized and 15% impacted by land modification activities. These figures are virtually identical to those for the study area as a whole. While large and obvious sites in all parts of the study area are being vandalized, the major impact is to sites in close proximity to population centers.

Table 12. Incidence of impacts to cultural resources

	Vandalism (Percent)	Other Disturbance (Percent)	Total (Percent)
Blue Ridge	5	81	86
Chevelon	4	7	11
Heber	12	5	17
Pinedale	10	18	28
Lakeside	5	11	16
Springerville	21	17	38
Alpine	14	00	14
FOREST	10	14	24

MANAGING THE FORESTS' RESOURCES

At this point, available information concerning cultural resources on the forests and their distribution has been assembled. The remaining issue is to define the management strategies that will result in the necessary level of protection to these resources. Five such strategies can be defined: (1) completion of the inventory of the study area, (2) protection of resources from other land use activities, (3) regulation of the consumption of the resource by the scientific community, (4) regulation of the consumption of the resource by the public, and (5) administrative studies. Each of these issues is addressed below.

INVENTORY GOALS

I originally envisioned writing a plan for a staged 100% survey of the forests, an approach consistent with Executive Order 11593. Considering the various topics discussed herein, such an approach to cultural resources in the area seems unproductive. First, such an approach presumes that a catalogue of what is there is the primary goal of future research concerning cultural resources and their distribution. This goal makes no more sense than the presumption that successful management planning requires an inventory of every tree or every acre of grazing land within the study area. one can plan a timber harvest program or wise use of the forests for grazing without such detailed information. In the same manner, one can plan for the wise managment of cultural resources without knowing where each and every one of them is located.

The original inventory goal assumes a condition that may exist on some of the nation's forests, but not on these forests; the assumption that cultural resources are relatively rare. It is difficult to speak of an expected 18,000 sites as a rare resource. That the resource is nonrenewable is clear. That without wise management it will disappear more quickly than many other resources managed by forests, is clear. That each and every cultural resource must be described in the same detail is unclear.

The investigative strategy required to know every resource in even approximately the same detail would be wasteful of the tax dollar. There are areas of the forests where the probability of encountering cultural resources is close to zero. Yet, the dollars required to inventory those acres differ insignificantly from the dollars required to inventory acres on which cultural resources occur in abundance. The major expense incurred in inventory work is getting to a cultural resource. In this sense, whether the result of an effort to get to a cultural resource is successful or unsuccessful, the expenditure is relatively the same. Thus, the question of means of accomplishing the inventory goal without pedestrain survey of the entire forests is a critical one.

Such an effort is inconsistent with the multiple-use philosophy of the Forest Service. Some resources are critical because they are used, trees for example. Others are important because their protection is in the public good. In the case of the latter, inventory is crucial to the extent that use activities sometimes have effects on protected resources. If use is not occurring in a particular location, impacts on cultural resources are unlikely.

Finally, an effort to achieve an overall inventory is unnecessary because the "consuming public" would have no use for its results. There are two possible definitions of the consuming public in regard to cultural resources, those who use them for recreation--the general public--and those who use them for knowledge--the scientific community. It is obvious that the general public has no concern for such a resource in the quantity of 18,000 cultural resource loci; and, scientific strategies for utilizing the evidence from 18,000 cultural resource loci do not exist at present, are unlikely to exist in the foreseeable future, and will be superceded by more economic strategies in the distant future.

For all of these reasons, it seems preferable to discuss the inventory problem not in terms of goals such as acres surveyed or sites recorded but in terms of how to achieve an increased understanding of how these resources can be routinely preserved and conserved as more "consumptive" activities are carried out on the forest, in much the same way as projects are defined so as to avoid major watershed impacts. This is not to say that there are no plans that need to be formulated for the consumers. These will be discussed later. The point made here is simply that there is a difference between the inventory task on the one hand and provisions for the wise use of the resource on the other. This last question will be discussed in a later section of the plan.

An inventory plan should articulate with other forest activities. When a particular area is to be impacted because of some project such as a timber harvest, fuelwood sale, or road construction, the designation of that area for a cultural resources survey is essentially random in regard to the cultural resources. The growth of the inventory in conjunction with, rather than separate from other forests goals, is ultimately consistent with archeological as well as management goals.

There is no justification for additional transect surveys for planning purposes. The distribution of resources described in this report is probably as good as can ever by achieved using such a device. In fact, and given that hind sight is always 100%, the current conclusions could have been reached with approximately 25% less effort, which--given that a substantial part of the effort was at no expense to the Forest Service--equates with about 10% less expenditure by the Forest Service--equates with about 10% less expenditure by the Forest Service in relation to the current project, given the substantial volunteered time.

Transects are an inefficient inventory unit for further research in these forests, even though they are an efficient planning unit. Inventory is best accomplished in more sizeable areas. There is ultimately some indecision as to what sites have been recorded and which have not, what areas have been surveyed and which have not when transects are used as a primary tool. Moreover, the critical planning information that is not contained, but only suggested in this report is local variation in site distributions. Only through the survey of relatively large blocks of land evenly spaced over the study area will such information be obtained.

Project areas are not always of a size useful for inventory purposes. Small and sinuous project areas provide a limited basis for spatial generalizations. For this reason, it will often prove useful to attach inventory dollars to project dollars to increase the size and regularity of the boundaries of a study area. In this way, inventory goals and other planning goals can be accomplished together.

There are some portions of the study area for which pedestrian survey is an inefficient means of obtaining an inventory. On those portions of the forests where site densities are high the cost of obtaining an inventory record, assuming a standard survey cost of $10 per acre, is about $160. Where site densities are very low, the cost rises to $6400 a site (if only a single site is found). While some gains in the efficiency of survey in low density areas are realized, the strategy is still not cost effective. In areas of the forests above 8200 feet, cultural resources likely to be found include shrines and historic sites. The former may often be documented using a check of likely loci--springs, peaks and promontories. The latter are perhaps best documented, although clearly not exhaustively, by records searches. None of this is to argue that every specific project will not require some effort to identify, conserve, and preserve cultural resources, only that the identification of all such resources is not best accomplished through a pedestrian inventory effort.

With these goals in mind, an inventory is probably best accomplished through a number of activities.

1. Drawing upon the conclusions of this study, on each district an effort should be made to identify the boundaries between areas with, and areas largely devoid of, cultural resources.

2. In areas where the density of resources is likely to be quite low, the inventory effort should focus on checks of likely locations in the case of prehistoric resources and on records searches in the case of historic resources.

3. In areas where site densities are likely to be high, an initial 10 percent sample should be used to define specific areas where resources occur. A 100 percent sample should be designed on the basis of the information obtained in this preliminary stage.

4. Where project areas are small and/or irregular, inventory dollars should be used to create larger and more regularly bounded study units.

5. Recognizing that national needs for resources on the forests change, inventory dollars should be used to fund studies lying in areas where immediate project needs are not substantial.

6. The immediate goal of such efforts should be greater understanding of local variation in cultural resources so that projects can be defined so as to avoid them. The long term goal is the inventory.

Implementation

A survey of the entire unsurveyed acreage within the study areas would cost roughly $12.5 million assuming an average cost of $10/acre during the time that the survey was done. Such an expense is unjustified from the perspective of wise planning for the preservation and conservation of cultural resources (roughly $700 per resource). There is no consumer of the resource that requires the information generated by such an expenditure.

A survey of roughly 850 square miles in which sites are likely to be found would cost roughly $5.5 million ($305 per resource). To accomplish this survey by 1984 would cost $1.088 million per year. To accomplish this survey by the year 2000 would cost $272,000 per year. It is unlikely that the funding level indicated by the former figure is attainable. Were it attainable, it is unlikely that sufficient archeological manpower could be found to accomplish the survey. The latter figure is more realistic from both financial and manpower perspectives. Nevertheless, a question remains as to whether there are less expensive means of inventorying the resources.

High altitude resources (above 8100 feet) are best handled by a combination of record checks and field inspection to cover historic resources and checks of likely locations for shrines and overlook sites. A single summer's study costing about $50,000 should suffice for locating most of these resources and for constructing predictive models with high confidence intervals of locations in which other such resources may be found.

Of the 910 square miles that are likely to have high cultural resource densities, 189 lie within areas where timber harvest is likely to occur. Because the potential impact of these activities is great, these areas should be surveyed in their entirety. The cost of this effort would be about $1.2 million. There is no reason why the survey cannot be scheduled in conjunction with, although ahead of, the harvest schedule. Assuming a 20 year period for completion of the survey, the cost would be $60,000 per year. Survey at this level is feasible in respect to archeological manpower.

Over the remainder of the forests impacts are less substantial and less continuous. In these areas, a survey of roughly 1/3 of the total acreage is suggested. The survey should be done in systematically spaced 2 miles by 2 miles blocks to ensure (1) large enough survey blocks to permit understanding of local variation in the spatial distribution of resources and (2) that no potential project area on the forests is more than 2 miles from at least two of the surveyed blocks and 2 miles from 4 blocks. Already surveyed areas should be incorporated into the grid system, they should be used as "growth nodes" to reduce the number of new acres that must be inventoried. Inventory in any one summer should be on a dispersed basis, the blocks should not be concentrated on any one district. Given that there are already inventoried acres, the survey of 250 new sections would result in information on about 10,000 cultural resources, a number that should be sufficient for virtually any foreseeable management or consumer problem. Spread over a 20 year period, the cost would be $80,000 per year.

Noninventoried areas should remain so until specific proposed impacts require inventory work in them. Between the survey blocks and already completed transects and quads, management ability to predict the density and distribution of cultural resources should be high. It would be advisable to use a combination of air photo study, ground truth checks and site visits to locate large and unique cultural resources within the non-inventoried areas, a project that could probably be done for about $50,000.

The total projected inventory budget for the next twenty years is $2,900,000 or $125,000 per year (about $160 for each resource).

PROTECTION FROM LAND USE ACTIVITIES

An earlier section of this document discussed the nature of impacts and described startegies either currently in use or that could be developed for avoiding further impacts to cultural resources. The continuation and improvement of these strategies is the primary basis for protection proposed in this study. One question remains, however: how to proceed when a situation arises where impacts to at least some cultural resources are unavoidable?

The answer to this question presupposes some effort to complete the inventory of the study area along the general lines just discussed. And, it assumes that there are about 18,000 such resources on the forests distributed among site types in the manner shown in the final column of Table 1. Further inventory will certainly result in the refinement of these figures. It also assumes that it is unlikely in the case of projects that have major impacts to acquire the level of funding sufficient to mitigate by a data recovery program all of the resources that are to be impacted. Given all of these assumptions, the quantity of such resources available for study and their distribution on different districts should serve as a major guide to decisions as to where mitigation dollars should be directed.

For example, the most abundant site type on the forests is an artifact scatter between 100 and 999 square meters in area. There are potentially 3894 such sites in the study area. There have been five excavation projects done at such sites in the last twenty years. If these sites are used by the scientific community at the rate of one every four years, the resource would not be spent until the year AD 17,555. By that date, archeologists, if they still exist as an identifiable profession, will be studying the archeology of us. To the extent that such prehistoric sites are still primary research foci, improvements in site discovery techniques, in the economy of analytical techniques, not to mention the vast amount of pertinent materials that will be stored in museums and at universities, will probably assure the adequacy of a data base in ways that we cannot currently envision. In the context of a multiple use philosophy, the expenditure of funds to protect or improve some other resource seems far more justifiable than the protection of cultural ones. At the same time, the distribution of such resources must be taken into account. For example, in the case of artifact scatters of the size we have been discussing, there are 33 times the number of such resources on the Pinedale district than on the Alpine district. On Alpine district they represent a far rarer resource and are therefore more crucial to interpreting the prehistory of that district.

It must also be recognized that there are within the study area resources even more scarce than the least abundant of those characterized in Table 1. Compounds, defensive sites, and multi-hundred room pueblos are examples of known sites. PaleoIndian sites are examples of types that may be present although they are not currently identified. These very rare site types warrant the highest degree of protection, especially in regard to vandalism.

SCIENTIFIC COMMUNITY

Archeologists are one major category of potential user of the cultural resources on the forests. Unfortunately, despite the use of the "conservation-preservation ethic" to ensure enlightened treatment of resources by public agencies, there is still some insensitivity to the impacts on resources created by archeologists. In one recent case, an archeologist working in Arizona chided the Forest Service for its insistence that a road be moved to avoid impacting a prehistoric site when the ADOT was willing to pay for the excavation and the archeologist was interested in undertaking it. Such a position is clearly inconsistent with the ethic in question. But, it is no less inconsistent than the behavior of a doctoral dissertation committee that fails to insist that students demonstrate the need to pursue a particular research project using newly recovered materials rather than existing collections. The profession as a whole has invested little effort in exploring the strengths and weaknesses of such collections, presuming that they were collected using techniques that are below current standards and thus, rendering them totally useless.

For these reasons, it is entirely appropriate that public agencies develop their own strategies for ensuring that the resources they seek to protect are never taken unnecessarily. While this discussion is of particular forests, the amelioration of the problem will most likely result from a coordinated effort at the regional level. If different forests have drastically different policies, more resources will be taken on some forests than others and our understanding of the region's history and prehistory correspondingly biased. A first step in that direction would involve systematic review of all research proposals by the regional archeologist and the forest archeologists sitting as a panel.

The subject of their review should be a document that is both a research design and demonstration that the resources that will be taken are essential to the success of the project in question. I use the term "essential" advisedly. Given that the greatest percentage of the region's cultural resources exist on private land, where they are totally unprotected, or on state lands, where the level of protection currently given them is far less than desirable and far less than that characteristic of federal lands, it is preferable that the scientific community take resources on state and private lands leaving the better protected ones on federal lands as a storehouse for the future.

Drawing upon the general literatures of anthropology and archeology and the more specific discussions in the Little Colorado Overview (Plog in press) and others that will undoubtedly be generated in the near future, a number of questions should be addressed.

1. What are the theoretical, methodological, and empirical goals of the project?

2. What specific theoretical, methodological, and empirical advances would result from the project?

3. What categories of data are necessary to the completion of the project and in what quantities must these data be available given the inferential techniques that will be used in the study?

4. Why are data from federal rather than from state or private land essential to the success of the project? What are the available options on the latter and why are these unsatisfactory?

5. What existing collections have been evaluated in regard to their adequacy for the study? Why is the recovery of new cultural materials essential to the success of the project?

Clearly, this list could be elaborated and the level of detail increased. But the above questions identify the general grounds on which particular projects can be evaluated to determine whether the taking of new resources from federal lands is essential.

INTERPRETIVE PROGRAMS

The goals of preservation/conservation and of interpretation are closely related. On the other hand, there is little justification for spending public monies on the conservation of cultural resources unless there is a social value to the product, that is, unless the resources are actually resources. Interpretation of those resources is the only means to reach that product both through the enjoyment that citizens obtain through seeing the material remains of past cultures and the education that results from actual interpretation of the lifestyles of prehistoric peoples. Education can be both direct and indirect. Direct education occurs when a cultural resource becomes a part of a display, exhibit, lecture, or publication that is readily available to the public. Indirect education occurs when the resource is used to contribute to understanding the past but in a more mundane scientific fashion; the results are in relatively inaccessible publications.

On the other hand, interpretation is essential to the conservation and preservation of cultural resources. The expenditure of funds that would be required to stop the destruction that is now occurring to sites on the forest because of illegal collecting and excavation would be close to unimaginable and might very well not succeed. Neither will the high penalties of the Archaeological Resources Protection Act cause this criminal behavior to stop. Tighter laws and stricter enforcement will ultimately increase the value of antiquities and the willingness of pothunters to continue their effots. This is not to say that legislation and stricter enforcement are not partial answers. Indeed, they are necessities. But, there must be positive reenforcement along with the negative. Preservation and conservation will ultimately be based in a concerned local community that sees efforts to protect the forests' resources as an integral part of maintaining the community.

Changing community attitudes toward cultural resources will not be an easy task. But, given the level of destruction described earlier, a negative attitude toward collecting and pothunting is a cost effective check on those activities. If concerned citizens begin to report such events, the burden falling on the forests is greatly decreased. If citizen awareness grows of the likelihood that their illicit activities may be reported, they will be less likely to engage in them. Similarly, a citizenry that is aware of the potential benefits of preserving the resources--benefits such as increased visits to the area and prolonged lengths of visits--is more likely to accept the necessity of protection and participate actively in it.

Awareness Program

Goal: To increase local awareness of cultural resources on the forest and their value to the local community.

The National Forests are in a unique position to interpret cultural resources at the local level. There are large numbers of sites on forests such as the Apache-Sitgreaves. These sites reflect a very great diversity of different peoples and time periods. The land-holding pattern is generally contiguous (unlike the BLM whose lands are dispersed). Local communities are in and adjacent to the forest and representatives of the forest live in those communities.

A first step in interpretation is forging a link between the forest and local communities for the benefit of both. This effort should focus on education and can be pursued in a number of different directions. The following specific efforts are suggested:

1. The forest could publish a booklet describing cultural resources on the forest, interpreting the same, describing their existing and potential value to the community, and mentioning the laws that protect these resources.

The preparation of descriptive material and illustrations for such a booklet should be in such a form that it can be distributed at district offices, at some camp grounds, and to interested local educational groups.

2. A slide and tape program could be developed.

The necessary slides are already on file. Thirty and sixty minute talks to accompany the slides could be taped.

3. Contacts could be initiated with local schools, church groups and service clubs and talks to these various groups scheduled.

The potential in this area is almost limitless. I have talked about the archeology of the area in forums ranging from service clubs to priesthood meetings of the Church of Jesus Christ of Latter Day Saints. There are enough different educational, religious, and civic groups in the vicinity of the Apache-Sitgreaves Forests that a schedule of one or two talks a week is not an impossibility. Given that the program is updated each year, this program could be continued indefinitely. Its implementation would require either full-time interpretive services assistance or training one or more individuals on each district in handling the program. Alternatively, the taped talk could be used for the verbal portion of the program.

Additional attention should be given to schools in the area. Segments of the social studies curriculum deal with local history and prehistory and with American Indians. At these points in the curriculum, the forest can provide major assistance in enriching the education of local students through the presentation of talks, the loan of artifactual materials, arranging visits to sites on the forest, and providing booklets on local prehistory. Efforts in the schools should be given high priority--the education of the next generation is a more productive path to protecting the forests' resources than changing the behavior of this one.

In the case of service clubs a somewhat pecuniary addendum is in order: to the extent that the resources are preserved and developed along some of the lines to be discussed later, the community will benefit economically.

4. A program of weekly or monthly press releases to local radio stations and newspapers could be initiated.

By the end of 1981, a wealth of digested material on the cultural resources of the forests will be available. At regular intervals short, 100-200 word stories discussing a specific aspect of forest prehistory could be released. The media are generally willing to publish the information. (I once wrote weekly columns for the Winslow newspaper.) To the extent that this effort can be regularized into a weekly/monthly archeology column or talk, its impact will be further increased.

5. The forest could foster the development of local archeological societies.

Whetting local interest in archeology without providing a means of satisfying that interest would be a mistake. An immediate means of providing a way of actually involving local citizens in archeology is founding a chapter of the Arizona Archaeological Society. This organization currently has chapters in a number of cities and towns throughout the state. Its members are active in visiting sites, and have been involved in fieldwork both on a paid and volunteer basis. One or more local societies would, on the one hand, provide a group of concerned local citizens with which a variety of forest efforts could articulate, and on the other hand, a pool of manpower for a variety of different tasks that might be undertaken on the forests. Direct forest involvement could involve the forest archeologist playing a guiding role in the founding of the society(ies), the provision of meeting facilities, the use of sites on the forest for some of the early field trips, and, possibly, for fieldwork training and experience as has been done on the Coconino National Forest.

The full range of activities described above is clearly beyond the limits of archeological manpower currently available on the forests. It could be accomplished either with a roughly half-time archeological assistant or an individual splitting time half-and-half between archeology and interpretive services.

Display Program

Goal: To provide brief visual interpretations of forest prehistory to visitors.

1. The forest could produce a poster concerning archeology and cultural resources for display at district offices, campground and other appropriate public locations.

This program is intended as a quick-and-dirty means of generating a display program. It would consist of a silk-screen multi-color poster with illustrations of a few interesting artifacts from the forest and three messages: 1) brief summary of forest prehistory (200 words), 2) discussion of the value of cultural resources (100 words), and 3) warning concerning the illegality of collecting (50 words).

2. The forest could produce a series of roughly one meter by one meter display boards for use at district offices.

These displays are intended as more sophisticated versions of the posters. Rather than illustrations, reproductions of artifacts would be attached to a solid wood back ground. The prose could be somewhat more extensive than that on the posters. Still, it should be possible to produce them for not more than $25-50 each.

3. The forest could produce a set of "archeological columns."

I use the jargon for want of a better term to describe the display I have in mind. Basically, it consists of a wooden box one meter on each side and two meters high. Two sides of the box are flat panels. On these sides there are prose descriptions of the prehistory of the forest on one side and of some specific aspect of the location where the column occurs on the other. The specific discussion might focus on a nearby site, the nature of the prehistoric occupation of a particular canyon or district, or simply on some interesting aspect of regional prehistory--the earliest corn cobs, the abandonment of the forest, etc.

The other two sides would be sealed cases. In one there would be a diaroma showing a reconstruction of one of the more interesting sites in the vicinity. In the other, there would be reproductions of chipped stone, ground stone and/or ceramic artifacts along with some interpretation of them.

This proposal is the heart of the display program. It is intended to be completely flexible. The columns could be located at district offices, in campgrounds, outside post offices, along highways--anywhere that made sense. The intention is to fit the specifics of each column to the location where it is found. A column at Correjo Crossing, for example, would describe the importance of the homestead there in local history. One at the Supervisor's Office would more likely deal with forests prehistory in general. Columns could occur singly or in groups. An excavated site might have several columns interpreting it and illustrating the work that was done there . Initial construction costs should be no more than $300-500 per column and maintenance costs, save for some inevitable vandalism (a factor for which local community interest will again be important), minimal. Once a dozen or more columns existed, it would also make sense to distribute a mimeographed sheet of their locations so that visitors could spend a Saturday or Sunday "touring" the forests' archeology as captured in the columns.

Interpretive Archeology

Goal: To develop a series of archeological parks that the public can visit for their education and enjoyment.

Discussing a large scale excavation-for-interpretation program taxes current understanding of the cultural resources on the forests and is difficult without at least some crude notion of likely funding levels. For this reason, my suggestions pertain more to broad principles rather than to specific work at specific locations.

1. The forest could undertake an inventory of the land lying within 300 meters of major highways and forest roads. The survey should occur along 20 miles of roadway in situations where archeological site density is likely to be high and land-use factors indicate suitability for hiking, camping, etc. The specific 20 miles should be selected so as to provide maximum possible dispersion over the forest. Survey should not be done in segments of less than .25 miles in length.

The purpose of the survey is to provide an inventory of archeological sites in easy-access situations. This information is unavailable at present. Some high quality sites near roadways are known (e.g., site 203 and the "fort," both along Forest Road 504). There are other sites with great interpretive potential that are substantial distances from roads (e.g., Stotts Ranch, Bear Ruin, East Lincoln Ridge). Reasonable decisions must be based on a balance of archeological potential and fiscal reality. Frequently, this will involve comparing similar sites at varied degrees of access. The survey would provide the data basis from which assessments could be made. "Typical" sites would be selected in easy-access locations. A few sites with particularly difficult access problems but with high interpretive value should be included in the plan. (While this survey is discussed here in respect to interpretation, it has a high priority in both administrative study and protective proposals discussed elsewhere.)

2. Interpretation should focus equally on many different aspects of archeology.

Archeological exhibits saturate the interest of the curious when they become monotonous. This is most likely to occur when displays are all of the same type--all excavated rooms for example. To avoid this problem, displays should have a number of different foci including, but not limited to:

(a) excavation--when possible, visitors can be directed to sites where they can watch ongoing excavation.

(b) survey--a transect-size area is fenced and the visitor is challenged to find the sites, fill out a sample site form, etc.

(c) vandalism--a badly potted site could be used to show what pothunters destroy, and what archeologists learn.

(d) site formation processes--the descriptive material at, and tour of, the site focus on how the site came to be. The depositional and post-depositional processes that created the site are illustrated.

(e) settlement patterns--a walking tour along trails through an area of dense but unexcavated sites to provide an understanding of inter-community patterns.

(f) excavated sites--to show architecture, activities, etc.

3. Interpretation should encompass the multiple-use goals of the forest.

The goals of educating the public concerning cultural resources and multiple-use management should be amenable to mutually reinforcing display strategies. Each prehistoric family was involved in a multiple use approach to the resources of the area in a way that the typical modern family is not. Most modern families utilize the forests in very limited ways--for recreation, for Christmas trees, for grazing the family herd. They are not dependent on nearly so wide a range of resources as were prehistoric peoples. It is only the Forest Service that is in a position to view the entire set of resources and to act for effective resolution of competing use needs in the same way that prehistoric families presumably did. A prehistoric family needed wood for fuel and for construction, but cutting the juniper and pinyon trees reduced the availability of foodstuffs and in some cases may have changed the climatic regime. In summary, discussions of how prehistoric families met there resource needs may be an effective means of explaining multiple-use strategies to the public.

At the same time, such an approach can help to directly and indirectly educate the public concerning cultural resources. First, the very use of the analogy is a means of educating the public to the potential importance of studying the past: at least some prehistoric peoples did mismanage their resources and had to abandon the areas where they lived. Second, specific cultural materials could be used in illustrations.

This approach could be implemented in a variety of ways. First, pamphlets could be written that describe the history of multiple use of the forests from earliest prehistoric to modern times. Second, archeological sites could be moved to or reconstructed in multiple use demonstration areas. Finally, descriptive material in all archeological exhibits should make reference to the multiple use concept.

4. Excavation and restoration should be directed to low maintenance products. Self-guided walking tours, sufficient to allow the handicapped access and at least occasionally specifically directed to particular handicapped groups, should be the norm at all exhibits. When camping facilities are associated with the exhibits, they should be pack-it-in, pack-it-out facilities. Displays should be archeological columns as described earlier.

5. There should be some provision for seasonal supervision of the sites. Interpretation would be greatly aided by two or more archeologically trained seasonal employees who spend portions of each week at different sites giving talks, answering questions, etc. These same employees could provide campfire talks at the larger campgrounds.

6. There should be local involvement in the planning, development, and operation of the interpretive program. The interpretive program is a community resource. If it succeeds, the increase in tourist dollars in the area will be substantial. Beyond economics, local citizens and their guests will be frequent visitors at the facilities. Finally, the public is an expert advisor as to what the public would like to see in such sites. One recent evaluation of the characteristic attitude of visitors to archeological and historic exhibits is that they are bored (Leone 1978). This comment taken in conjunction with the rapidly increasing rate of visitation suggests that the public wants more from such exhibits than it is currently getting.

After planning, volunteers of time and resources can greatly assist in excavation and development. Later, volunteers could carry on demonstration excavation programs and even serve as docents for particular exhibits. Finally, volunteers and an interested local community can provide the ultimate protection for those exhibits.

7. Interpreteive development should be done at the forest and multi-forest levels. The development of major interpretive exhibits should be primarily a forest responsiblity. A great potential would be lost, however, were there not some inter-forest cooperation, specifically between the Apache-Sitgreaves, Tonto and Coconino Forests. Three of the largest and most interesting sites on the forests are near Winslow (Chavez Pass), Payson (Shoo-fly), and Heber (Stotts Ranch). Developing these sites with a degree of coordination so as to facilitate a driving tour of the archeology of the area would enhance the interpretive value of each.

ADMINISTRATIVE STUDIES

There are undoubtedly effective means of managing the forests' cultural resources that are not described in this document because they have not been tried. Administrative studies are necessary in a number of areas to improve management strategies.

1. Low density artifact scatters. For reasons discussed earlier, a fuller understanding of low density artifact scatters could have immediate benefits to management activities.

2. Site signature study. The Forest is now in possession of high quality airphotos. It is essential to determine as quickly as possible the potential utility of these in locating cultural resources. An appropriate procedure involves using a stereo viewer to find esoteric vegetation or soil patterns that may represent archeological site "signatures." These locations are then checked for "ground truth," to determine which signatures are false and which are in fact indicative of sites. Control of typical site signatures in an area--and they cannot always be found--is a means of quickly estimating the likelihood of finding resoures in a particular project area.

3. Site formation processes baseline. Quite apart from specific human impacts that result in the deterioration of the quality of the archeological record on the forests, there are a variety of continuing unpreventable natural impacts, such as, trampling by herd animals, excavation by rabbits, badgers, coyotes, etc. In discussing the impact that a particular project has on a resource, it would be very useful to have some standard other than "the pristine archeological site" with which to compare a probable impact. To establish such a baseline, it would be necessary to generate information on roughly 100 randomly chosen archeological sites on the forests. The sites should be in a variety of different locational contexts (both cultural and natural) and should have suffered a variety of obvious previous impacts. Low level air photos of the sites requiring probably ten hours of helicopter time could be used to generate site maps and for an overall assessment of current major impacts. Roughly one day of collecting at each site using a formal grid system would provide a basis for a baseline characterization of the artifactual materials. In addition, some artifacts would be field analyzed and left in situ. Periodic studies at a sample of these sites each year in ten year intervals would provide a relatively continuous monitoring of the impacts the sites suffer. Given the continuation of the study for several decades, it is likely that land modification and other projects will be carried out in their vicinity, allowing a comparison of a great range of different impacts.

4. Site surface renewal. A few sites in the study area have been collected several different times within the last 100 years. Partial collections have been made from over 2000 sites. The rapidity with which the surface of sites is renewed is an important consideration in evaluating impacts. If the artifacts that occur on the surface of a site at some point in time are a subset of all those that have ever been there and the set that contains those which will be there in a decade, then protection against surface impacts is a significant consideration. Alternatively, if the surface of a site is "renewed" at a sufficient rate that the same quantity and types of artifacts endure over long periods of time, then protection against only the most extreme impacts is warranted.

Recollecting a sample of already collected sites and testing to see whether a variety of inferences that might be made using surface materials have changed or remained the same is a beginning. Close articulation between surface renewal studies and the studies described in item 3 are, in the long run, a source of more sophisticated information that may reduce the preventive actions that need to be taken in the face of particular impacts.

5. Sites and fires. The probability that most archeological sites found on the forests have been burned over by a forest fire at least once is quite high. The effect of burning on sites is unknown. Yet, that burning may have seriously affected the quantity and quality of materials available on sites. Bone, for example, is present in subnormal quantities on sites on the forest. Yet, there is no obvious characteristic of soil chemistry or hydrology that explains the poor preservation that has been observed. Periodic forest fires may be the problem. This

issue can be addressed by three administrative studies. (a) Excavating sites in an area immediately after a major fire. Especially when some parts of a site have been impacted more than others, the extent of degradation of the archeological record by the fires can be estimated. (b) It is justifiable to use some sites, partially excavated in advance, in areas where slash is to be burned to begin to understand this impact. (c) Sites could be "built" and then burned.

6. Juniper pushes and animal habitat. Juniper pushes are justified on the grounds that they increase the quantity and quality of grass for animals. The direct impact of pushes on archeological sites is alleviated when boundaries are shifted to avoid sites. If, as a result of a push, carrying capacity is increased and animals move to the remaining vegetated areas for shade, the indirect impact on archeological sites in the vicinity of the push may be substantial. Archeologists recognize the great destruction that occurs on sites where the density of cattle is high--sherds are very small, chipped stone is characterized by "cow retouch." A systematic before-after study of sites in the vicinity of pushes would help to resolve this issue. There is no reason to believe that pushing would become so overwhelming an impact through greater animal densities so as to make it inadvisable. However, wider boundaries around cultural resources might be warranted.

CONCLUSION

In the final analysis, this document is an experiment. As noted earlier, the concept of planning for cultural resources is new as is, for that matter, the concept of cultural resource management. I know of no greater measure of the magnitude of change that has occurred in the last decade than the contrast between this document and the cultural resources study that I did for the original Mogollon Rim Planning Unit. That latter involved a series of pencil lines drawn around areas where I suspected site densities might be high after about five minutes thought on the matter. Yet, I am equally certain that the gap between this study and what is considered to be an acceptable management document ten years from now will be as large.

The commitment to the wise managment of cultural resources is now a substantial one. Certainly, there are new conceptual tools that will be developed to improve management abilities. Similarly, future studies will almost automatically correct some of the inadequacies of this one. I do not anticipate that every single suggestion I have made in this document will be implemented. My hope is that these ideas will stimulate further thinking and refinement of planning and management strategies that will benefit both the scientist, the manager, and the public.

APPENDIX

This appendix is furnished as a quick summary of several important management items taken from the chapter on Quantity, Distribution, and Predicting location of Cultural Resources. The listing is by Ranger District.

DISTRICT SUMMARIES

Alpine

1. Sample transect survey extent - partial coverage.

2. Total area likely to have sites - 50 square miles, 40%.

3. Estimated number of sites - 422.

4. Estimated site density per square mile - 4.8.

5. Estimated acres of cultural resources per section - 1.2 minimum, 3.0 maximum.

6. SYMAP - Generally clustered pattern with relatively moderate densities in even the most densely occupied areas.

7. Patterning 1: Overall - site density is low, but there is great variation from area to area in where sites are located. Sites generally occur in clusters surrounded by areas without sites.

8. Site encounter implications - Few projects (relatively) will encounter cultural resources. When these are encountered they will be present in moderate numbers, but a slight shift in project boundaries, when this is feasible, may completely alleviate the problem.

9. Site spacing - randomly distributed.

10. Site density by elevation - 7500-8100 feet, 0.46 per square mile; above 8100 feet., 0.06 per square mile.

11. Vegetation - Wolfberry good site indicator.

12. Soils - Soils associated with sites are: Schoens gravelly sandy loam, Bluegrass gravelly sand loam, Bluegrass-Roundy-Whipple association, Dickers-Jacks association complex, McVickers sandy loam, Woolhouse gravelly loam, Polson gravelly sandy loam, Wishbone-Ecks complex, and Tenny-Flume complex. Bluestem-Penrod complex, Springerville clay, Bluestem-Springerville complex and Thunderbird Penrod complex.

Chevelon

1. Sample transect survey extent - complete coverage.

2. Total area likely to have sites - 90 square miles, 20%.

3. Estimated number of sites - 4435.

4. Estimated site density per square mile - 26.7.

5. Estimated acres of cultural resources per section - 6.9 minimum, 26.3 maximum.

6. SYMAP - areas of high site density surrounded by zones of decreasing density in a reasonably smooth pattern.

7. Patterning - 5: Site density is high and spatial variation great. Nevertheless there is fairly even zonation to the pattern of density change.

8. Site encounter implications - The probability of encountering resources is quite high. Most projects will encounter cultural resources; while there will be great density variation, a slight adjustment in project boundaries is unlikely to change the situation.

9. Site spacing - randomly distributed

10. Site density by elevation - 6000-6499, 1.90; 6500-6999, 2.68

11. Vegetation - there is a significant difference between pinyon-juniper and ponderosa pine-alligator juniper with no sites occurring in the latter community

12. Soils - analysis suggests that densities will be nearly four times as high in

sections where the Tortugas and Purner-Dye soils predominate than in sections where either Purner or Dye is common. In planning cultural resource management strategies; the percentage of the different soil types in the project area can be used as a means of modifying the estimate based on mean densities for the district alone.

Heber

1. Sample transect survey extent - complete coverage.

2. Total area likely to have sites - 205 square miles, 58%.

3. Estimated number of sites - 12,412.

4. Estimated site density per square mile - 30.3.

5. Estimated acres of cultural resources per section - 12.3 minimum, 34.9 maximum.

6. SYMAP - areas of high site density surrounded by zones of decreasing density in a reasonably smooth pattern.

7. Patterning - 3: densities are high and spatial variation relatively low.

8. Site encounter implications - a slight shift in project boundaries will rarely result in much advantage given the even pattern of variation in densities. Most projects of any substantial size will encounter some resources.

9. Site spacing - clustered.

10. Site density by elevation - under 6000, 7.00; 6000-6499, 1.86; 6500-6999, 2.23; 7000-7499, 0.14.

11. Vegetation - Site density is highest in pinyon-juniper; near zero in ponderosa.

12. Soils - Not studied

Lakeside

1. Sample transect survey extent - complete.

2. Total area likely to have sites - 125 square miles, 60%.

3. Estimated number of sites - 2,200.

4. Estimated site density per square mile - 11.5.

5. Estimated acres of cultural resources per section - 1.1 minimum, 2.9 maximum.

6. SYMAP - There is only a single high density area and several quite distinct lower density clusters.

7. Patterning - 2: Overall densities are moderate, but there is substantial variation from one location to another over the district. Areas of high site density are randomly dispersed, there are both zones and isolates of high density areas.

8. Site encounter implications - projects will likely encounter sites, although not in very great numbers nor in a very predictable fashion. The random spatial variation in density means that the advantages of slight shifts in project boundaries will be unpredictable, although advantages will be realized some percentage of the time.

9. Site spacing - randomly distributed.

10. Site density by elevation - under 6000, .88; 6000-6499, .31; 6500-6999, .81; 7000-7499, .43.

11. Vegetation - Agavi parryi and saltbush often grow on archeological sites.

12. Soils - Soils associated with sites are: Schoens gravelly sandy loam, Bluegrass gravelly sandy loam, Bluegrass-Roundy-Whipple association, Dickers-Jacks association and complex, McVickers sandy loam, Woolhouse gravelly loam, Polson gravelly sandy loam, Wishbone-Ecks complex, and Tenny-Flume complex. Soils associated withe absence of sites are Mystery Rock Outcrop complex, Bluestem-Penrod complex, Springerville clay, Bluestem-Springerville complex and Thunderbird Penrod complex.

Pinedale

1. Sample transect survey extent - complete.

2. Total area likely to have sites - 295 square miles, 89%.

3. Estimated number of sties - 13,915.

4. Estimated site density per square mile - 27.6.

5. Estimated acres of cultural resources per section - 4.8 minimum, 9.7 maximum.

6. SYMAP - areas of high site density somewhat constricted and tortuous surrounded by zones of decreasing density in a reasonably smooth pattern.

7. Patterning - 4: density is high and variation from one locus to another relatively low. The pattern of variation in density is more random, less evenly zoned than on Heber District and therefore somewhat less predictable.

8. Site encounter implications - the relatively random variation in density means that the advantage of slight shifts in project boundaries will be unpredictable but may sometimes be realized.

9. Site spacing - randomly distributed.

10. Site density by elevation - under 6000, 1.67; 6000-6499; 1.36; 6500-6999, 1.32.

11. Vegetation - the pattern is quite complex with high site densities possible in most communities.

12. Soils - Soils associated with sites are: Schoens gravelly sandy loam, Bluegrass gravelly sandy loam, Bluegrass-Roundy-Whipple association, Dickers-Jacks association and complex, McVickers sandy loam, Woolhouse gravelly loam, Polson gravelly sandy loam, Wishbone-Ecks complex, and Tenny-Flum complex. Soils associated with the absence of sites are Mystery Rock Outcrop complex, Bluestem-Penrod complex, Springerville clay, Bluestem-Springerville complex and Thunderbird Penrod complex, for the eastern edge of the district.

Springerville

1. Sample transect survey extent - complete.

2. Total area likely to have sites - 95 square miles, 28%.

3. Estimated number of sites - 1,036.

4. Estimated site density per square mile - 6.0.

5. Estimated acres of cultural resources per section - 1.6 minimum, 5.4 maximum.

6. SYMAP - Not Available.

7. Patterning - 1: Overall, site density is low, but there is great variation from area to area in where sites are. Sites generally occur in clusters that are surrounded by areas without sites.

8. Site encounter implications - few projects (relatively) will encounter cultural resources. When these are encountered they will be present in moderate numbers, but a slight shift in project boundaries, when this is feasible, may completely alleviate the problem.

9. Site spacing - clustered.

10. Site density by elevation - 7500-8100, .47.

11. Vegetation - wolfberry is a good site indicator

12. Soils -site densities are highest in areas with the following soils: Nutrioso Loam, Herschede gravelly, Saffel loam, and Indian Tank loam.

Blue Ridge

1. Sample Transect survey extent - partial coverage.

2. Total area likely to have sites - 50 square miles, 20%.

3. Estimated number of sites - 1,320.

4. Estimated site density per square mile - 12.25.

5. Estimated acres of cultural resources per section - 6.7 minimum, 21.0 maximum.

6. SYMAP - a very small high density area and a realtively erratic pattern of density variation.

7. Patterning - 2: Overall densities are moderate, but there is substantial variation from one location to another over the district. Areas of high site density are randomly dispersed, there are both zones and isolates of high density areas.

8. Site encounter implications - projects will likely encounter sites, although not in very great numbers nor in a very

predictable fashion. The random spatial variation in density means that the advantages of slight shifts in project boundaries will be unpredictable although advantages will be realized some percentage of the time.

9. Site spacing - randomly distributed.

10. Site density by elevation - 6000-6499, 1.07; 6500-6999, .56.

11. Vegetation - site densities are highest in pinyon-juniper.

12. Soils - not studied.

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